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# Final
# Remedial Investigation Work Plan
for
# Area of Concern (AOC) R
at the
## Former U.S. Naval Ammunition Support Detachment (NASD)
## Vieques Island, Puerto Rico

NAVFAC
Naval Facilities Engineering Command

Prepared for
## Department of the Navy
### NAVFAC ATLANTIC

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# Resumen Ejecutivo

Este plan de trabajo presenta las actividades de Investigación de Remediación (RI por sus siglas en inglés) propuestas, para el sitio del Área de Preocupación R (AOC R por sus siglas en inglés), que se identificó dentro del Antiguo Destacamento Naval de Apoyo de Municiones (NASD por sus siglas en inglés) localizado en la porción oeste de la isla de Vieques, Puerto Rico. El sitio fue investigado previamente como parte de la Evaluación Preliminar Extendida/Investigación del Sitio (PA/SI por sus siglas en inglés), Segunda Fase, Reporte de los Siete Sitios (CH2M HILL, 2002) y el Estudio Ambiental Base (EBS por sus siglas en inglés) (Program Management Company [ERM], 2000). Los resultados analíticos de estas investigaciones indicaron la necesidad de más investigaciones en AOC R. Por lo tanto, se propone recoger información adicional como parte de los esfuerzos RI para caracterizar el sitio aun más y definir la naturaleza y extensión de la contaminación en el sitio.

AOC R fue previamente utilizada como área de almacenamiento durante proyectos de construcción y área de operación de obras públicas durante los años de 1965 al 1971. Este sitio está localizado a lo largo de la carretera 200, aproximadamente a 1.5 millas al este de la Laguna Kiani y 580 pies al sur de la línea costera. La loza grande de concreto que se encuentra en el sitio ya estaba presente antes de que la Marina adquiriera el área y se puede observar en fotos aéreas tomadas en el 1937. Para finales de la década de los 1960, un taller de carpintería y un club para reclutas son ubicados en esa loza. Actividades ligeras de mantenimiento de vehículos tales como cambios de aceite eran realizados cerca de la loza hacia el noroeste. Un tanque de almacenaje sobre la tierra (AST por sus siglas en inglés) estuvo localizado una vez cerca del edificio 401 y su contenido es desconocido. Además, se han identificado en el sitio varias áreas de escombros conteniendo piezas de municiones.

Un modelo conceptual del sitio para AOC R, identifica las áreas antes descritas como fuente potencial de contaminación. Derrames, escapes u otras liberaciones de estas áreas, si ocurrieron, pueden haber contaminado el suelo. La contaminación del suelo, si alguna, pudo haber emigrado a la corriente efímera localizada cerca del límite oeste del sitio y/o lixiviarse hacia el agua subterránea abajo.

Para proveer una evaluación adecuada sobre la naturaleza y la extensión de la contaminación en el AOC R, se recogerán para análisis aproximadamente 29 muestras de suelo superficial y 15 de suelo bajo la superficie. Además, siete pozos de monitoreo de agua subterránea serán instalados en el sitio. También se recogerán muestras de la corriente efímera para determinar si las aguas de escorrentías en contacto con los escombros o áreas de municiones pudiesen haber afectado adversamente la corriente. Todas las muestras que se recojan durante las Investigaciones de Remediación serán analizadas para compuestos orgánicos volátiles (VOCs por sus siglas en inglés), compuestos orgánicos semi-volátiles

***Note:*** *This summary is presented in English and Spanish for the convenience of the reader. Every effort has been made for the translations to be as accurate as reasonably possible. However, readers should be aware that the English version of the text is the official version.*

***Nota:*** *Este resumen se presenta en inglés y en español para la conveniencia del lector. Se han hecho todos los esfuerzos para que la traducción sea precisa en lo más razonablemente posible. Sin embargo, los lectores deben estar al tanto que el texto en inglés es la versión oficial.*

(SVOCs por sus siglas en inglés), explosivos, pesticidas, bifenilos policlorinados (PCB por sus siglas en inglés) para desarrollar un mejor entendimiento de la naturaleza y extensión de la contaminación en el sitio, si ésta existe.

Los resultados de estos esfuerzos de muestreo, al igual que la información obtenida previamente como parte de la PA/SI extendido, serán utilizados para evaluar los riesgos potenciales a la salud humana y al ambiente. Si los resultados de la evaluación de riesgos indican que las concentraciones de componentes en el sitio no representan un riesgo no aceptable a la salud humana y al ambiente, no se recomendarán evaluaciones o acciones de remediación adicionales en el Reporte RI. De no ser así, se recomendarán investigaciones adicionales si se necesita de más datos, ó un Estudio de Factibilidad (FS por sus siglas en inglés) será recomendado si se identifican niveles de riesgo potenciales no aceptables que requieran remediación.

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**NOTA:** ESTE RESUMEN SE PRESENTA EN INGLÉS Y EN ESPAÑOL PARA LA CONVENIENCIA DEL LECTOR. SE HAN HECHO TODOS LOS ESFUERZOS PARA QUE LA TRADUCCIÓN SEA PRECISA EN LO MÁS RAZONABLEMENTE POSIBLE. SIN EMBARGO, LOS LECTORES DEBEN ES TAR AL TANTO QUE EL TEXTO EN INGLÉS ES LA VERSIÓN OFICIAL.

# Executive Summary

This work plan presents proposed Remedial Investigation (RI) activities at Area of Concern (AOC) R site identified within the Former Naval Ammunition Support Detachment (NASD) located on the western portion of Vieques Island, Puerto Rico. The site was previously investigated as part of the Expanded Preliminary Assessment/Site Investigation (PA/SI), Phase II, Seven Sites Report (CH2M HILL, 2002) and the Environmental Baseline Survey (EBS) (Program Management Company [ERM], 2000). Analytical results from these investigations indicated a need for further investigation at AOC R. Therefore, additional data collection is proposed as part of this RI effort to further characterize the site and define the nature and extent of contamination in the site media.

AOC R was used as a construction staging area and public works operational area from approximately 1965 to 1971. The site is located along Highway 200 approximately 1.5 miles east of Laguna Kiani and 580 ft south of the coastline. The large concrete pad at the site was present before the Navy owned the area and can be seen in 1937 aerial photographs. In the late 1960s, a carpentry shop and an enlisted club were located on the pad. Light vehicle maintenance activities, such as oil changes, were conducted near the pad to the northwest. An above-ground storage tank (AST) was once located near Building 401, and its contents are unknown. In addition, several debris areas containing munitions items have been identified at the site.

A conceptual site model for AOC R identifies the areas described above as potential contaminant source areas. Spills, leaks, or other releases from these areas, if they occurred, could have contaminated soil. Soil contamination, if present, could migrate to the ephemeral stream located near the western boundary of the site and/or leach to the underlying groundwater.

In order to adequately assess the nature and extent of contamination at AOC R, approximately 29 surface soil samples and 15 subsurface soil samples will be collected for analyses. Additionally, seven groundwater monitoring wells will also be installed across the site. Samples in the ephemeral stream will also be collected to determine if runoff from debris and/or munitions areas have adversely affected the stream. All samples collected during the RI will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), inorganics, explosives, pesticides, and polychlorinated biphenyls (PCBs) to develop an adequate understanding of the nature and extent of contamination at the site, if present.

The results of this sampling effort, as well as the previous data from the Expanded PA/SI, will be utilized, as appropriate, to evaluate potential risks to human health and the environment. If the risk assessment results indicate that constituent concentrations at the site do not pose an unacceptable risk to human health and the environment, no further evaluation or remedial action will be recommended in the RI report. Otherwise, further investigation will be recommend if additional data are needed, or a feasibility study (FS) will be recommended if unacceptable levels of potential risk are identified that require remediation.

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# Acronyms and Abbreviations

| | |
|---|---|
| AOC | Area of Concern |
| ARAR | applicable or relevant and appropriate requirement |
| AST | aboveground storage tank |
| ASTM | American Society for Testing and Materials |
| AWQC | ambient water quality criteria |
| BIP | blow-in-place |
| bls | below land surface |
| CDI | chronic daily intake |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CLP | contract laboratory program |
| COC | chain-of-custody |
| COPC | chemical of potential concern |
| CSM | conceptual site model |
| DAF | dilution attenuation factor |
| DO | dissolved oxygen |
| DQE | data quality evaluation |
| DQO | data quality objective |
| DRO | diesel range organics |
| DV | data validation |
| EBS | Environmental Baseline Survey |
| EDD | electronic data deliverable |
| EPC | exposure point concentration |
| ERA | ecological risk assessment |
| ERB | equipment rinsate blank |
| ERM | Environmental Resources Management Group |
| ESS | Explosive Safety Submission |
| EZ | exclusion zone |
| FS | Feasibility Study |
| FSP | field sampling plan |
| ft | foot/feet |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GRO | gasoline range organics |
| HEAST | Health Effects Assessment Summary Tables |
| HHERA | human health and ecological risk assessment |
| HI | health index |
| HQ | hazard quotient |

| | |
|---|---|
| HSP | Health and Safety Plan |
| IR | Installation Restoration |
| IRIS | Integrated Risk Information System |
| LCS | laboratory confirmation sample |
| LCSD | laboratory confirmation sample duplicate |
| LOAEL | Lowest Observed Adverse Effect Level |
| MCL | maximum contaminant level |
| MDL | method detection limit |
| MEC | munitions and explosives of concern |
| mg/kg | milligrams per kilogram |
| MOV | Municipality of Vieques |
| MS/MSD | matrix spike/matrix spike duplicate |
| NAPR | U.S. Naval Activity Puerto Rico |
| NASD | Former Naval Ammunition Support Detachment |
| NAVFAC | Naval Facilities Engineering Command |
| NFA | no further action |
| NFG | National Functional Guidelines |
| NOAEL | No Observed Adverse Effect Level |
| ORP | oxidation reduction potential ORO oil range organics |
| ORS | ordnance related scrap |
| OVM | organic vapor meter |
| PAH | polynuclear aromatic hydrocarbons |
| PARCC | precision, accuracy, representativeness, completeness, and comparability |
| PA/SI | Preliminary Assessment/Site Investigation |
| PCB | polychlorinated biphenyl |
| PRAP | Proposed Remedial Action Plan |
| PREQB | Puerto Rico Environmental Quality Board |
| PRG | Preliminary Remediation Goal |
| PRG-I | Industrial Preliminary Remediation Goal |
| PRG-R | Residential Preliminary Remediation Goal |
| PVC | polyvinyl chloride |
| QAPP | Quality Assurance Project Plan |
| QA/QC | Quality Assurance/Quality Control |
| RAGS | Risk Assessment Guidance for Superfund |
| RAO | Remedial action objective |
| RFP | Request for Proposals |
| RGO | remedial goal option |
| RI | Remedial Investigation |
| SMDP | Scientific Management Decision Point |
| SOP | Standard Operating Procedure |

| | |
|---|---|
| SOW | Scope of Work |
| SSL | soil screening level |
| SVOC | semi-volatile organic compound |
| SWMU | Solid Waste Management Unit |
| TAL/TCL | Target Analyte List/Target Compound List |
| TDS | total dissolved solids |
| TEF | toxicity equivalency factors |
| TM | Technical Memorandum |
| TOC | total organic carbon |
| TPH | total petroleum hydrocarbons |
| TRC | Technical Review Committee |
| UCL95% | 95 Percent Upper Confidence Limit |
| USEPA | U.S. Environmental Protection Agency |
| USGS | U.S. Geological Survey |
| UTL | Upper Tolerance Limit |
| UXO | unexploded ordnance |
| VOC | volatile organic compound |

SECTION 1

# Introduction

This work plan presents the Remedial Investigation (RI) rationale and technical approach for sampling analysis and data evaluation to be conducted at Area of Concern (AOC) R located within the Former Naval Ammunition Support Detachment (NASD) in Vieques, Puerto Rico. The location of the Former NASD is shown in Figure 1-1. The scope of this RI work plan is based on previous investigations conducted at AOC R. The AOC R location and the locations of other Solid Waste Management Units (SWMUs) and AOCs are shown in Figure 1-2. An historical aerial photograph of the AOC R area is shown in Figure 1-3.

On May 24, 2000, as part of the Environmental Baseline Survey (EBS) for the closure of the Former NASD, Environmental Resources Management Group (ERM) conducted a site visit. No visual evidence of contamination of the area was identified. However, due to the presumed historical activities at the site and lack of information regarding those activities, the site was recommended to undergo a full investigation in the Installation Restoration (IR) program (Program Management Company, 2000). AOC R was later investigated as part of the Expanded Preliminary Assessment/Site Investigation (PA/SI), Phase II, Seven Sites (CH2M HILL, 2002), with the Puerto Rico Environmental Quality Board (PREQB) as the lead regulatory agency. Based on the results of the Expanded PA/SI, an RI was deemed necessary for AOC R.

This work plan provides a general description of the tasks that will be performed to conduct the RI for AOC R, with the U.S. Environmental Protection Agency (USEPA or EPA) Region 2 as the lead regulatory agency. Detailed descriptions of sampling equipment, analysis procedures, quality assurance protocols, health and safety requirements, and community relations planning procedures are presented in the facility-wide Master Work Plan for the Former NASD (CH2M HILL, 2001). The Master Work Plan includes the following six plans, which are common to all work performed within the Former NASD:

- Project Management Plan
- Master Quality Assurance Plan
- Data Management Plan
- Health & Safety Plan
- Investigation-Derived Waste Management Plan

As appropriate and for efficiency, relevant information from the Master Work Plan is not repeated in this work plan. The Health and Safety Plan (HSP), site-specific checklists, and data screening criteria are included in Appendixes A, B, and C, respectively. The Electronic Data Deliverable format for CH2M HILL is included in Appendix D. Qualifier Flags and Two-Digit Code Definitions for Comment Field are included in Appendix E. Final Responses to USEPA and PREQB comments on the revised draft report are included in Appendix F. The munitions response program procedures for AOC R are included in Appendix G. The Final Meeting

Minutes – Vieques Technical Subcommittee Meeting, March 29-30, 2005 are included in Appendix H. The Final Memorandum – Summary of Site Visits, June 21, 2005 is included in Appendix I, the Final Meeting Minutes – Vieques Technical Subcommittee Meeting, June 21-22, 2005 is included in Appendix J, and the Final Meeting Minutes – Vieques Technical Subcommittee Conference Call, October 11, 2005 is included in Appendix K. These meeting minutes contain discussions and consensus reached for various topics relevant to AOC R.

## 1.1 Objectives of the RI at AOC R

The RI will be completed in accordance with the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and will generally follow the interim final *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988).

The primary objectives of the RI at AOC R include:

- Conduct a field data collection program to adequately define the nature and extent of contamination present in the surface soil, subsurface soil, groundwater, surface water, and sediment, if present.
- Prepare an RI report that includes an assessment of potential human health and ecological risks based on the nature and extent of contamination.

If the RI determines that no unacceptable risks to human health or the environmental exist, the Feasibility Study (FS) will not be prepared; rather, No Further Action (NFA) will be proposed in a Proposed Remedial Action Plan (PRAP). Otherwise, additional investigation or an FS will be proposed, as applicable.

## 1.2 Organization of the Work Plan

This RI Work Plan is organized as follows:

*Section 1, Introduction,* provides general background information regarding the RI, and summarizes the purpose of the investigation.

*Section 2, Site Background and Physical Setting,* describes the location and environmental history of the facility, discusses previous investigations, and provides information concerning the physical setting of the sites.

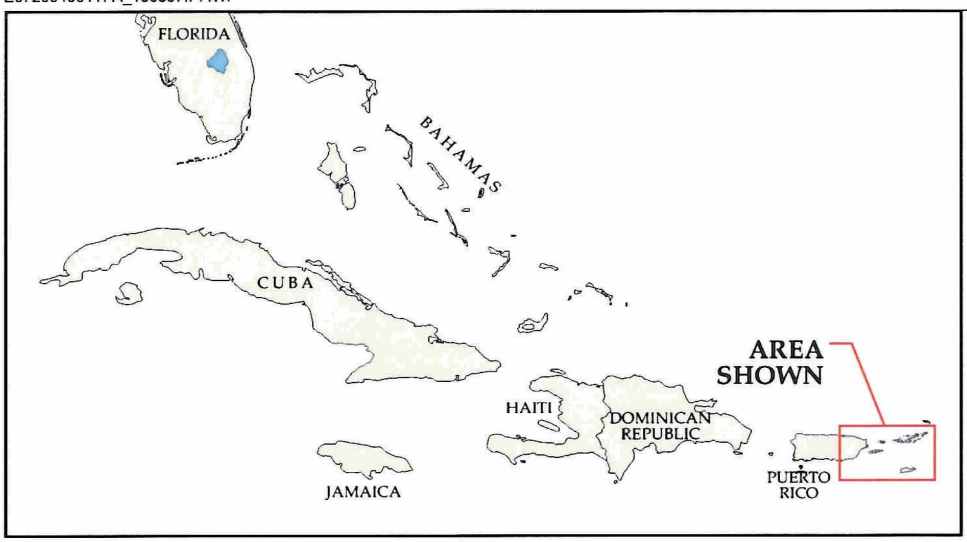
*Section 3, Initial Evaluation and Conceptual Site Model,* presents the conceptual site model (CSM) developed during the project scoping phase, which describes the potential migration and exposure pathways of site contaminants. This section also summarizes the preliminary assessment of human health and environmental impacts from site-related activities.

*Section 4, RI Technical Approach and Investigation Procedures,* provides the purpose and a description of the proposed sampling within each site. These descriptions include site-specific RI site characterization tasks adapted from the detailed tasks identified in the Quality Assurance Project Plan (QAPP) and the Field Sampling Plan (FSP) of the Master Work Plan.

*Section 5, Remedial Investigation Report,* describes the general outline of the RI report.

*Section 6, Project Schedule,* presents the anticipated RI schedule based on the scope of the project, and identifies key activities and delivery dates.

*Section7, References,* presents a listing of works referenced during compilation of the RI Work Plan.



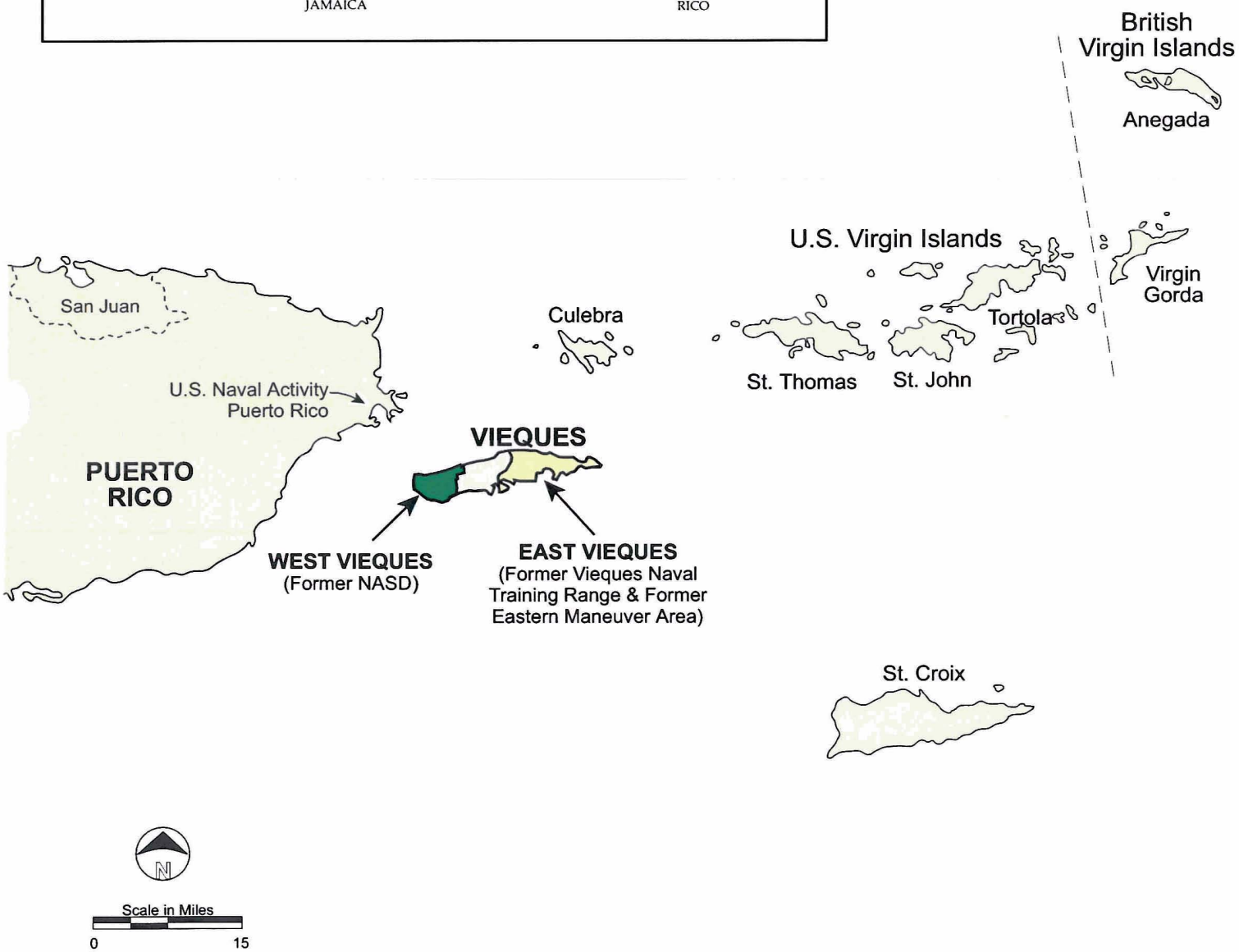
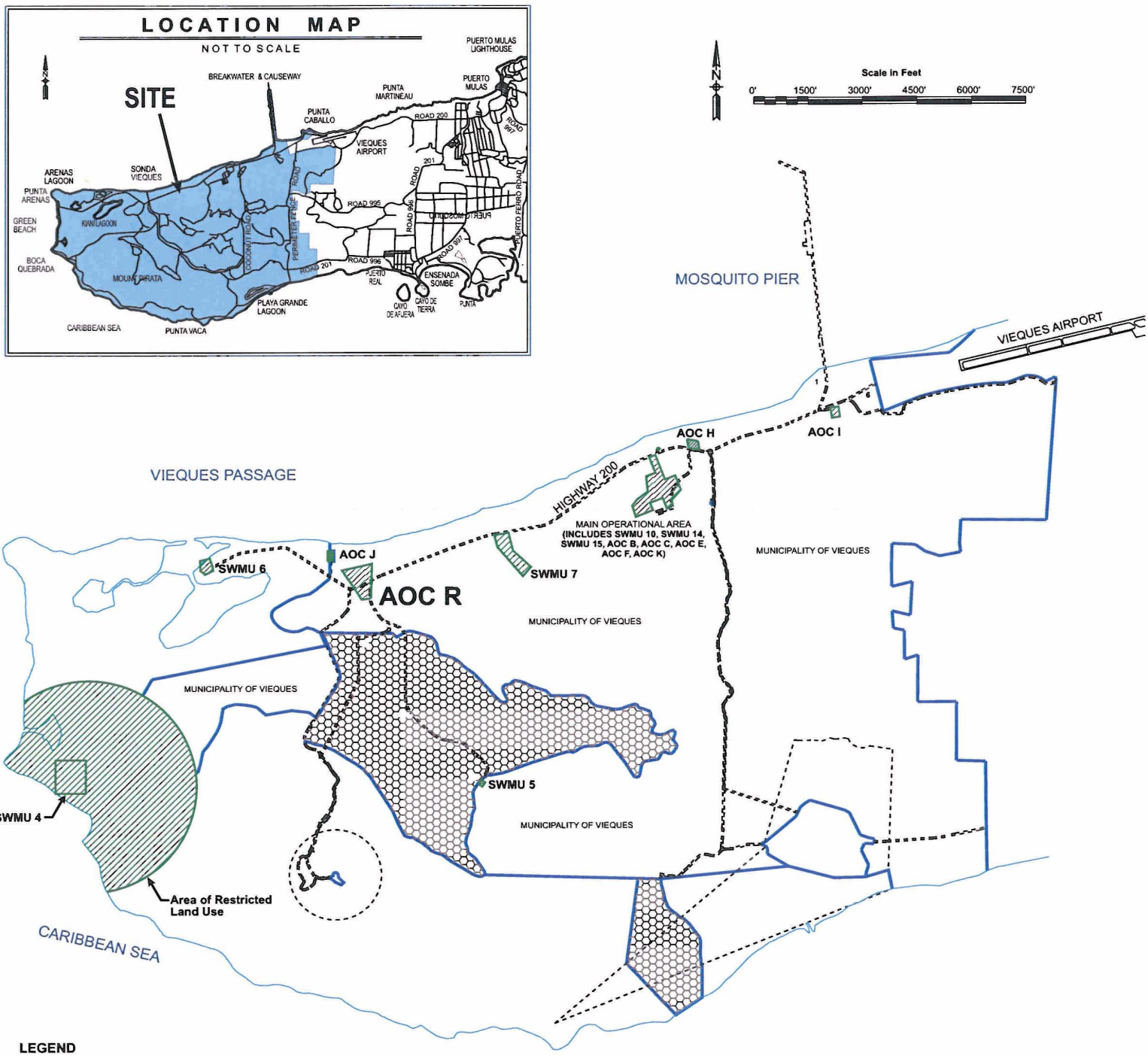




**Figure 1-1**
**Regional Location Map**
*Vieques, Puerto Rico*

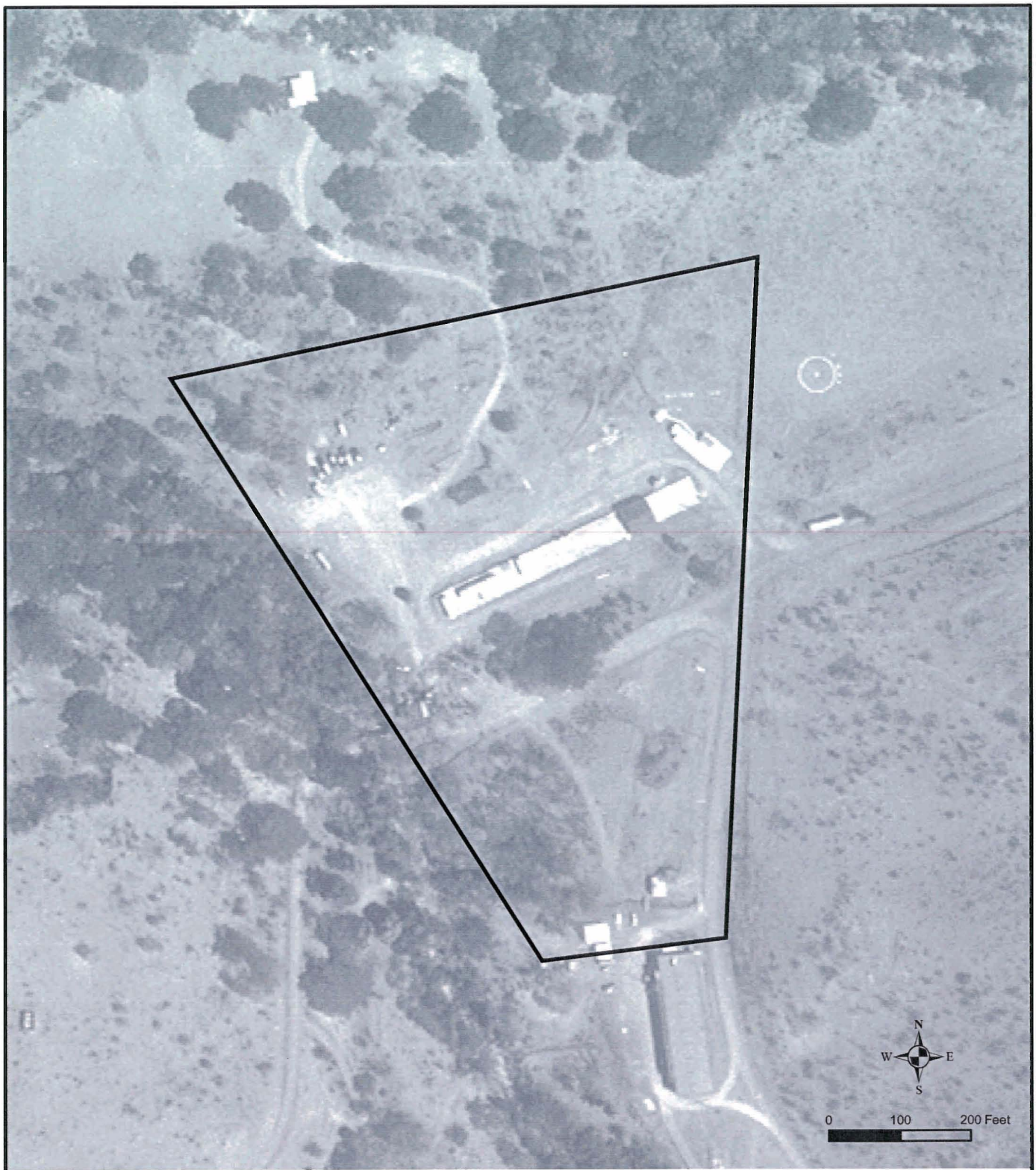



**LEGEND**

| | |
|---|---|
| PROPERTY LINE | |
| EASEMENT LINE | |
| APPROXIMATE EDGE OF WATER | |
| UNITED STATES GOVERNMENT\ DEPARTMENT OF THE INTERIOR | |
| PUERTO RICO\CONSERVATION TRUST | |
| AREA OF RESTRICTED LAND USE AT SWMUs AND AOCs | |

*SOURCE*:
VIEQUES NASD SURVEY LAND TRANSFER & DISPOSAL OVERALL LOCATION SURVEY
PREPARED BY GLENN & SADLER AND LUIS BERRIOS MONTES & ASSOCIATES

**Figure 1-2**
**AOC R Site Location Map**
*Former NASD, Vieques, Puerto Rico*




Source: 1967 Aerial

**Legend**

Access Restriction Boundary

**Figure 1-3**
**Aerial Photography, AOC R**
*Former NASD, Vieques, Puerto Rico*

CH2MHILL

File Path: \\tampa\projects\Environmental\180357 RIFS for AOCs I, R NASD Vieques\GIS\AOC R.mxd. Date: 02.26.2004, User: Shaney

SECTION 2

# Site Background and Physical Setting

This section summarizes the available information on the Former NASD site (i.e., AOC R) to be investigated further under this RI Work Plan. This information was obtained from previous reports prepared for AOC R, and includes subsections describing the site setting, regional and site-specific geology and hydrogeology, and previous investigations.

## 2.1 Site Setting

AOC R was used as a construction staging area and public works operational area from approximately 1965 to 1971. The large concrete pad north of Highway 200 at AOC R was present before the Navy owned the area, and can be seen in 1937 aerial photographs. The nature of the pad's use prior to the 1960s is unknown. Currently, the pad has numerous cracks. In the late 1960s, a carpentry shop and an enlisted club were located on the pad. Light vehicle maintenance activities, such as oil changes, were conducted near the pad to the northwest. A large aboveground storage (AST) was once located near Building 401, south of Highway 200. Figure 2-1 presents a topographic map for AOC R. Figure 2-2 shows the location of AOC R within the Former NASD. Figure 2-3 presents a photograph of recent site conditions.

During the initiation of field investigations for the RI in August 2004, munitions and explosives of concern (MEC) items were identified in the vicinity of AOC R at three locations. Figure 2-4 shows the locations of the MEC items. Subsequent inspection of the MEC items by a UXO Technician suggested the MEC items identified were inert. However, due to the identification of the items, the site was characterized as a Munitions Response Site, the environmental investigations were postponed, and an Explosive Safety Submission (ESS) completed to assess the explosive safety risk for future investigations at the site. In addition, the work plan was revised to include munitions avoidance and removal activities, as well as additional investigation modifications concurred upon by the stakeholder agencies.

## 2.2 Geology and Hydrology

The geology of Vieques is characterized by volcanic rocks generally overlain by alluvial deposits and patches of limestone. Volcanic andesites, deposited in a marine environment, were intruded by a quartz-diorite plutonic complex that is exposed over a large percentage of the island. A gradual change in texture from coarse to fine-grained quartz-diorite has been observed from west to east. Limestone occurs in sectors of the northern, southern, and eastern parts of the island. The most extensive areas of limestone are found on the south coast peninsulas. The limestone is generally soft, yellowish, and well-indurated where exposed to the atmosphere. The sedimentary deposits consist of a mixture of sand, silt, and clay. The floodplains consist of beach and dune deposits formed by calcite, quartz, volcanic rock fragments, and minor magnetite (U.S. Geological Survey [USGS], 1989).

The Master Work Plan for the Former NASD (CH2M HILL, 2001) contains a detailed description of the geology of the area.

No previous hydrogeologic investigations have been performed at AOC R. However, wells installed at nearby sites indicate that the soil conditions are generally sandy clay with silty alluvial deposits. Groundwater flow direction can be assumed to be northerly toward the Vieques Passage, generally following the contour of the land surface.

## 2.3 Previous Investigations

A background study was conducted for the western portion of Vieques Island. The primary purpose of the study was to develop a set of background values for inorganic constituents that occur commonly in environmental media for comparison with sites investigated within the Former NASD. The background inorganic constituent levels from the background study are used for comparison with soil inorganic constituent levels in samples collected during the site investigations at SWMUs and AOCs (such as AOC R).

During the background investigation, surface soil samples were collected from 0 to 6 inches below land surface (bls) at 26 surface locations. Subsurface soil samples were collected from 11 locations at depths ranging from 2 to 6 ft bls. Data from analyses of these soil samples were not statistically different and were combined to make a comprehensive background soil data set. Table 2-1 lists all the background soil inorganics identified and their concentrations. The upper tolerance limit (UTL) values established for soil inorganics are used for comparison with the soil samples collected from site AOC R.

The Expanded PA/SI report (CH2M HILL, 2002) and the EBS (Program Management Company, 2000) are the only investigations conducted to date at AOC R. The subsections below summarize information from these previous investigations.

### 2.3.1 Environmental Baseline Survey

During the Environmental Baseline Survey (EBS) a review/interview of suspected areas from aerial photography analysis with several long-time employees at NASD Vieques. Activities in the AOC R area included a carpentry shop and light vehicle maintenance. A site visit was accomplished on May 24, 2000 and visual observations of the area did not identify any concerns. Due to lack of additional information, this site was recommended to undergo a full investigation under the Navy's IR program (Program Management Company, 2000).

### 2.3.2 Expanded PA/SI

The Expanded PA/SI at AOC R included the collection of 34 surface soil samples. The samples were analyzed for inorganics (also referred to as metals), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs).

### Surface Soil Sampling

A total of 34 surface soil samples were collected at AOC R; 10 of these samples were collected around the vehicle operations area, and 24 samples, spaced approximately every 50 ft, were collected from around the perimeter of the concrete pad.

### Field Screening Results

Soil samples were screened in the field for VOCs using an organic vapor meter (OVM). This field screening method provides a qualitative evaluation of potential organic constituents in soil. No elevated VOC levels were noted. The soil boring logs in Appendix A of the Expanded PA/SI report included the OVM results.

### Laboratory Analytical Results

This subsection presents the interpretation of the analytical data from the AOC R Expanded PA/SI report (CH2M HILL, 2002). The discussion includes the identification of screening/regulatory criteria exceedances.

Concentrations of detected constituents were compared to USEPA Region 9 screening criteria for residential and industrial preliminary remedial goals (PRGs), leachability criteria, and ecological screening criteria for soil. Detected constituents were also compared to NASD background levels. Table 2-2 lists all exceedances of screening criteria used.

Appendix H of the Expanded PA/SI report (CH2M HILL, 2002) contained a compilation of all constituent concentrations. Appendix I of the Expanded PA/SI report contained the data validation summary.

### Surface Soil Results

Aluminum, arsenic, chromium, cobalt, copper, iron, manganese, lead, nickel, vanadium, and zinc were detected in surface soil samples at concentrations exceeding the industrial PRGs (PRG-I), residential PRGs (PRG-R), ecological screening criteria, and/or leachability soil screening level (SSL20). Arsenic, chromium, cobalt, copper, iron, lead, vanadium, and zinc were also identified at concentrations above the background metals values established for the Former NASD.

Several SVOC concentrations exceeded industrial and residential PRGs. Based on review of aerial photographs and interviews with long-term Navy personnel, no previously-paved roads were identified at AOC R other than the main road (Highway 200) that passes through the site.

Parameters exceeding either the PRGs, ecological criteria, or SSL criteria and background are listed in the following sections and are shown in Figure 2-5.

### Metals

- Out of 34 samples collected, three exceedances of arsenic ranging from 3.6 to 15 mg/kg (PRG-R value of 0.39 mg/kg); background level is 2.2 mg/kg.
- Out of 34 samples collected, two exceedances of chromium both at 82 mg/kg (Eco screening criteria value of 0.4 mg/kg and SSL20 value of 38 mg/kg); background level is 74 mg/kg.

- Out of 34 samples collected, one exceedances of cobalt at 26 mg/kg (Eco screening criteria value of 13 mg/kg); background level is 25 mg/kg.
- Out of 34 samples collected, nine exceedances of copper ranging from 69 to 100 mg/kg, (Eco screening criteria value of 50 mg/kg); background level is 68 mg/kg.
- Out of 34 samples collected, two exceedances of iron ranging from 39,000 to 40,000 mg/kg (PRG-R value of 2,350 mg/kg); background level is 37,531 mg/kg.
- Out of 34 samples collected, one exceedance of lead ranging at 150 mg/kg (Eco screening criteria value of 120 mg/kg); background level is 6.9 mg/kg.
- Out of 34 samples collected, two exceedances of vanadium at 140 mg/kg (PRG-R value of 54.75 mg/kg and Eco screening criteria value of 2 mg/kg); background level is 130 mg/kg.
- Out of 34 samples collected, one exceedance of zinc at 71 mg/kg (Eco screening criteria value of 50 mg/kg); background level is 65 mg/kg.

**SVOCs**

- Out of 34 samples collected, one exceedance of 3,3'-dichlorobenzidine at 0.049 mg/kg (PRG-R value of 1.08 mg/kg; PRG-I of 5.48 mg/kg; SSLD20 at 0.01 mg/kg).
- Out of 34 samples collected, four exceedances of benzo(a)anthracene ranging from 0.793 to 5.93 mg/kg (PRG-R value of 0.62 mg/kg; PRG-I of 2.89 mg/kg; SSLD20 of 2.00 mg/kg).
- Out of 34 samples collected, five exceedances of benzo(b)fluoranthene ranging from 0.902 to 8.82 mg/kg (PRG-I value of 2.89 mg/kg; SSLD20 of 5.00mg/kg).
- Out of 34 samples collected, 11 exceedances of benzo(a)pyrene ranging from 0.06 to 4.93 mg/kg (PRG-R value of 0.06 mg/kg; PRG-I of 0.29 mg/kg).
- Out of 34 samples collected, two exceedances of indeno(1,2,3-c,d)pyrene ranging from 0.775 to 1.52 mg/kg (PRG-R value of 0.62 mg/kg).
- Out of 34 samples collected, six exceedances of dibenzo(a,h)anthracene ranging from 0.083 to 0.565 mg/kg (PRG-R value of 0.06 mg/kg; PRG-I of 0.29 mg/kg).

VOCs, pesticides, and PCBs either were not detected or were detected at concentrations below applicable screening criteria as shown in Table 2-2.

### 2.3.2.1 Ecological Survey

During the PA/SI investigation an ecological survey was conducted at the AOC R site. Information from this survey is included in this section. AOC R contains a large concrete pad that extends the full width of the site. The vegetation immediately surrounding the concrete pad had been cleared for soil sampling. The concrete pad was dominated by a sparse cover of herbaceous plants. Six vine species were recorded at AOC R; this was the highest number found at any of the AOCs surveyed. Shrubs and trees were found mostly along the edge of the concrete pad and its immediate surroundings. The dominant shrub species was wild-tantan. Sweet acacia (*Acacia farnesiana*), red manjack (*Cordia collococca*), be-

still tree (*Rauvolfia tetraphylla*), and papaya (*Carica papaya)* were also observed but at lower densities. Species of herbaceous plants observed in the cleared area included garlic weed (*Petiveria alliacea*), better man better (*Achyrantes aspera*), bretonica prieta (*Melochia nodiflora*), and *Jatropha* sp. The vegetation of this site prior to clearing was probably very similar to the adjacent scrub forest.

Many wildlife species were observed utilizing the vegetated areas, concrete pad, edges of the cleared areas, and the adjacent habitat. The sides of the concrete pad provide shade, foraging areas, and cover for the common, garden, and spotted anoles, which were abundant. A mongoose was observed crossing the trail that led to the northern cleared area. Habitat for birds included thorn scrub and coastal forest adjacent to the concrete pad. Many birds were observed using the edges of the cleared area around the concrete pad, trails, and brush piles for perches. The most common birds at the site were gray kingbirds, bananaquits, and greater Antillean grackles (*Quiscalus niger*). Bird species included those that would typically be found in coastal forest and thorn scrub habitat. An osprey (*Pandion haliaetus*) was observed flying northward toward the ocean over the adjacent vegetation.

No federally-protected species or preferred habitats were observed at this site.

The surface drainage at AOC R appears to be to relatively flat within the access restriction boundary. The general surface water flow in the area is to the northeast toward the coastline, based on the topography as shown on Figure 2-1.

Appendix F of the Expanded PA/SI (CH2M HILL, 2002) included a detailed ecological survey report.

**Table 2-1**
Vieques Soil Sample Background Concentration Estimates
*Former NASD, Vieques, Puerto Rico*

| Parameter | Units | Combined Soil Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Dist | N | Min | Max | Mean | UTL | | UCL |
| Aluminum | mg/kg | L | 37 | 1,600 | 29,000 | 9,573 | **29,000** | * | **12,821** |
| Antimony | mg/kg | NP | 37 | 0.35 | 2.3 | 0.67 | **2.3** | | **0.8** |
| Arsenic | mg/kg | L | 37 | 0.57 | 2.5 | 0.93 | **2.5** | * | **1.1** |
| Arsenic (SUBSURFACE SOIL) | mg/kg | N | 11 | 0.71 | 2.5 | 1.0 | **2.5** | | **1.4** |
| Arsenic (SURFACE SOIL) | mg/kg | L | 26 | 0.57 | 2.2 | 0.89 | **2.2** | | **1.0** |
| Barium | mg/kg | L | 37 | 6.4 | 320 | 65 | **320** | * | **104** |
| Beryllium | mg/kg | N | 37 | 0.13 | 0.46 | 0.21 | **0.45** | | **0.24** |
| Cadmium | mg/kg | NP | 37 | ND | ND | 0.033 | **0.040** | | **0.017** |
| Calcium | mg/kg | NP | 35 | 1,700 | 210,000 | 29,849 | **210,000** | | **44,232** |
| Chromium, TOTAL | mg/kg | NP | 37 | 2.2 | 74 | 16 | **74** | | **21** |
| Cobalt | mg/kg | NP | 37 | 1.0 | 25 | 8.2 | **25** | | **10** |
| Copper | mg/kg | NP | 37 | 1.8 | 68 | 23 | **68** | | **27** |
| Iron | mg/kg | N | 37 | 2,500 | 39,000 | 16,884 | **37,531** | | **19,549** |
| Lead | mg/kg | L | 36 | 0.30 | 6.9 | 3.3 | **6.9** | * | **4** |
| Magnesium | mg/kg | L | 37 | 1,200 | 16,000 | 4,146 | **12,834** | | **5,087** |
| Manganese | mg/kg | N | 37 | 48 | 1,200 | 478 | **1,167** | | **0,567** |
| Mercury | mg/kg | L | 37 | 0.0037 | 0.031 | 0.013 | **0.031** | * | **0.014** |
| Nickel | mg/kg | NP | 37 | 0.67 | 40 | 7.2 | **40** | | **10** |
| Potassium | mg/kg | L | 37 | 380 | 1,700 | 918 | **1,700** | * | **1,031** |
| Selenium | mg/kg | NP | 37 | 0.68 | 2.0 | 0.66 | **2.0** | | **0.5** |
| Silver | mg/kg | NP | 37 | ND | ND | 0.069 | **0.084** | | **0.036** |
| Sodium | mg/kg | NP | 37 | 25 | 6,300 | 1,069 | **6,300** | | **1,519** |
| Thallium | mg/kg | NP | 37 | 0.45 | 0.67 | 0.42 | **0.67** | | **0.26** |
| Vanadium | mg/kg | L | 37 | 9.0 | 130 | 50 | **130** | * | **66** |
| Zinc | mg/kg | N | 37 | 3.5 | 71 | 29 | **65** | | **33** |

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects

NA = not available -- sample size too small
ND-- Not detected in background soil media
Range of detection limits for pooled samples without detects:

Cadmium: 0.028-0.04 mg/kg
Silver: 0.059-0.084 mg/kg

Dist = type of data distribution
**95th UTL(UCL)** = 95th percentile Upper Tolerance Limit (95% upper confidence limit)

NP = nonparametric
N = normal
L = lognormal

**Table 2-1**
Vieques Soil Sample Background Concentration Estimates
*Former NASD, Vieques, Puerto Rico*

| Parameter | Units | QS Soil Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Dist | N | Min | Max | Mean | UTL | | UCL | |
| Aluminum | mg/kg | L | 12 | 1,600 | 11,000 | 3,875 | 11,000 | | 5,416 | |
| Antimony | mg/kg | N | 12 | 0.35 | 1.0 | 0.53 | 1.0 | * | 0.6 | |
| Arsenic | mg/kg | N | 12 | 0.70 | 2.5 | 1.3 | 2.5 | * | 1.6 | |
| Arsenic (SUBSURFACE SOIL) | mg/kg | N | 4 | 1.1 | 2.5 | 1.7 | 2.5 | * | NA | |
| Arsenic (SURFACE SOIL) | mg/kg | N | 8 | 0.70 | 2.1 | 1.1 | 2.1 | * | NA | |
| Barium | mg/kg | N | 12 | 6.4 | 24 | 15 | 24 | * | 18 | |
| Beryllium | mg/kg | N | 12 | 0.13 | 0.41 | 0.23 | 0.41 | * | 0.30 | |
| Cadmium | mg/kg | NP | 12 | | | 0.036 | 0.040 | * | 0.019 | * |
| Calcium | mg/kg | L | 10 | 25,000 | 210,000 | 84,000 | 210,000 | | 102,366 | |
| Chromium, TOTAL | mg/kg | NP | 12 | 2.6 | 48 | 9.4 | 48 | | 15 | |
| Cobalt | mg/kg | NP | 12 | 1.0 | 13 | 2.9 | 13 | | 5 | |
| Copper | mg/kg | L | 12 | 1.8 | 35 | 9.8 | 35 | | 20 | |
| Iron | mg/kg | L | 12 | 2,500 | 18,000 | 6,475 | 18,000 | | 9,350 | |
| Lead | mg/kg | N | 12 | 0.30 | 6.9 | 2.8 | 6.9 | * | 4 | |
| Magnesium | mg/kg | L | 12 | 1,300 | 11,000 | 3,842 | 11,000 | | 6,192 | |
| Manganese | mg/kg | L | 12 | 48 | 360 | 132 | 360 | | 202 | |
| Mercury | mg/kg | N | 12 | 0.0037 | 0.016 | 0.0091 | 0.016 | * | 0.011 | |
| Nickel | mg/kg | NP | 12 | 0.67 | 26 | 3.9 | 26 | | 7 | |
| Potassium | mg/kg | L | 12 | 380 | 1,700 | 859 | 1,700 | | 1,150 | |
| Selenium | mg/kg | NP | 12 | | | 0.61 | 0.68 | * | 0.32 | * |
| Silver | mg/kg | NP | 12 | | | 0.075 | 0.084 | * | 0.040 | * |
| Sodium | mg/kg | N | 12 | 300 | 6,300 | 2,803 | 6,300 | * | 3,836 | |
| Thallium | mg/kg | NP | 12 | | | 0.45 | 0.50 | * | 0.23 | * |
| Vanadium | mg/kg | L | 12 | 9.0 | 63 | 22 | 63 | | 33 | |
| Zinc | mg/kg | L | 12 | 3.5 | 31 | 12 | 31 | | 19 | |

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects

NA = not available -- sample size too small
ND-- Not detected in background soil media
Range of detection limits for pooled samples without detects:

Cadmium: 0.028-0.04 mg/kg
Silver: 0.059-0.084 mg/kg

Dist = type of data distribution
**95th UTL(UCL)** = 95th percentile Upper Tolerance Limit (95% upper confidence limit)

NP = nonparametric
N = normal
L = lognormal

**Table 2-1**
Vieques Soil Sample Background Concentration Estimates
*Former NASD, Vieques, Puerto Rico*

| Parameter | Units | KTD Soil Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Dist | N | Min | Max | Mean | UTL | | UCL | |
| Aluminum | mg/kg | N | 13 | 6,900 | 18,000 | 11,346 | 18,000 | * | 13,053 | |
| Antimony | mg/kg | N | 13 | 0.52 | 1.4 | 0.68 | 1.4 | * | 0.8 | |
| Arsenic | mg/kg | N | 13 | 0.57 | 1.2 | 0.72 | 1.2 | * | 0.9 | |
| Arsenic (SUBSURFACE SOIL) | mg/kg | NP | 3 | 0.87 | 1.0 | 0.96 | 1.0 | | NA | |
| Arsenic (SURFACE SOIL) | mg/kg | N | 10 | 0.57 | 1.2 | 0.65 | 1.2 | * | 0.9 | |
| Barium | mg/kg | L | 13 | 20 | 190 | 84 | 190 | | 129 | |
| Beryllium | mg/kg | N | 13 | 0.13 | 0.27 | 0.17 | 0.27 | * | 0.02 | |
| Cadmium | mg/kg | NP | 13 | -- | -- | 0.031 | 0.036 | * | 0.016 | * |
| Calcium | mg/kg | N | 13 | 2,800 | 9,100 | 4,838 | 9,100 | * | 5,742 | |
| Chromium, TOTAL | mg/kg | L | 13 | 2.2 | 52 | 13 | 52 | | 29 | |
| Cobalt | mg/kg | N | 13 | 6.7 | 13 | 9.1 | 13 | * | 10 | |
| Copper | mg/kg | N | 13 | 15 | 47 | 28 | 47 | * | 34 | |
| Iron | mg/kg | N | 13 | 14,000 | 28,000 | 20,692 | 28,000 | * | 23,118 | |
| Lead | mg/kg | N | 13 | 1.1 | 5.7 | 3.2 | 5.7 | * | 4 | |
| Magnesium | mg/kg | N | 13 | 1,500 | 7,200 | 3,985 | 7,200 | * | 4,810 | |
| Manganese | mg/kg | N | 13 | 290 | 1,200 | 626 | 1,200 | * | 738 | |
| Mercury | mg/kg | N | 13 | 0.0037 | 0.024 | 0.011 | 0.024 | * | 0.014 | |
| Nickel | mg/kg | L | 13 | 1.3 | 18 | 5.1 | 18 | | 10 | |
| Potassium | mg/kg | N | 13 | 520 | 1,400 | 875 | 1,400 | * | 1,019 | |
| Selenium | mg/kg | NP | 13 | 0.73 | 0.73 | 0.54 | 0.73 | | 0.35 | |
| Silver | mg/kg | NP | 13 | | | 0.065 | 0.076 | * | 0.034 | * |
| Sodium | mg/kg | L | 13 | 25 | 310 | 116 | 310 | | 0,204 | |
| Thallium | mg/kg | N | 13 | 0.45 | 0.46 | 0.39 | 0.46 | * | 0.28 | |
| Vanadium | mg/kg | N | 13 | 29 | 80 | 53 | 80 | * | 61 | |
| Zinc | mg/kg | N | 13 | 23 | 53 | 36 | 53 | * | 40 | |

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects

NA = not available -- sample size too small
ND-- Not detected in background soil media
Range of detection limits for pooled samples without detects:

Cadmium: 0.028-0.04 mg/kg
Silver: 0.059-0.084 mg/kg

Dist = type of data distribution
**95th UTL(UCL)** = 95th percentile Upper Tolerance Limit (95% upper confidence limit)

NP = nonparametric
N = normal
L = lognormal

**Table 2-1**
Vieques Soil Sample Background Concentration Estimates
*Former NASD, Vieques, Puerto Rico*

| Parameter | Units | QA Soil Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Dist | N | Min | Max | Mean | UTL | | UCL |
| Aluminum | mg/kg | N | 12 | 5,000 | 29,000 | 13,350 | 29,000 | * | 17,291 |
| Antimony | mg/kg | L | 12 | 0.59 | 2.3 | 0.81 | 2.3 | | 1.0 |
| Arsenic | mg/kg | L | 12 | 0.66 | 2.2 | 0.78 | 2.2 | | 1.7 |
| Arsenic (SUBSURFACE SOIL) | mg/kg | N | 4 | 0.71 | 0.71 | 0.43 | 0.7 | * | NA |
| Arsenic (SURFACE SOIL) | mg/kg | N | 8 | 0.66 | 2.2 | 0.95 | 2.2 | * | NA |
| Barium | mg/kg | L | 12 | 30 | 320 | 94 | 320 | | 145 |
| Beryllium | mg/kg | N | 12 | 0.13 | 0.46 | 0.24 | 0.46 | * | 0.29 |
| Cadmium | mg/kg | NP | 12 | -- | -- | 0.033 | 0.036 | * | 0.017 |
| Calcium | mg/kg | L | 12 | 1,700 | 45,000 | 11,817 | 45,000 | | 31,602 |
| Chromium, TOTAL | mg/kg | L | 12 | 4.5 | 74 | 26 | 74 | | 65 |
| Cobalt | mg/kg | N | 12 | 4.3 | 25 | 13 | 33 | * | 16 |
| Copper | mg/kg | N | 12 | 9.1 | 68 | 31 | 68 | * | 40 |
| Iron | mg/kg | N | 12 | 12,000 | 39,000 | 23,167 | 39,000 | * | 27,755 |
| Lead | mg/kg | N | 11 | 1.4 | 6 | 3.96 | 6 | * | 4.76 |
| Magnesium | mg/kg | L | 12 | 1,200 | 16,000 | 4,625 | 16,000 | | 8,354 |
| Manganese | mg/kg | N | 12 | 260 | 1,200 | 663 | 1,200 | * | 808 |
| Mercury | mg/kg | N | 12 | 0.0048 | 0.031 | 0.018 | 0.031 | * | 0.022 |
| Nickel | mg/kg | L | 12 | 1.8 | 40 | 13 | 40 | | 38 |
| Potassium | mg/kg | N | 12 | 570 | 1,400 | 1,023 | 1,400 | * | 1,174 |
| Selenium | mg/kg | L | 12 | 0.68 | 2.0 | 0.85 | 2.0 | | 0.99 |
| Silver | mg/kg | NP | 12 | -- | -- | 0.069 | 0.077 | * | 0.036 |
| Sodium | mg/kg | L | 12 | 50 | 1,200 | 367 | 1,200 | | 0,881 |
| Thallium | mg/kg | NP | 12 | 0.67 | 0.67 | 0.43 | 0.67 | | 0.30 |
| Vanadium | mg/kg | N | 12 | 34 | 130 | 73 | 130 | * | 90 |
| Zinc | mg/kg | N | 12 | 17 | 71 | 38 | 71 | * | 47 |

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects

NA = not available -- sample size too small
ND-- Not detected in background soil media
Range of detection limits for pooled samples without detects:

Cadmium: 0.028-0.04 mg/kg
Silver: 0.059-0.084 mg/kg

Dist = type of data distribution
**95th UTL(UCL)** = 95th percentile Upper Tolerance Limit (95% upper confidence limit)

NP = nonparametric
N = normal
L = lognormal

Table 2-2
Surface Soil Analytical Data Detection Summary
AOC - R, NASD, Vieques, PR

| Parameter | Units | BKG | 2005 ECO - ss | 2005 PRG-I 1E-6) | 2005 PRG-R (HI=0.1, risk 1E-6) | 2005 SSLD20 | StationID | AOCRSS001 | AOCRSS002 | AOCRSS003 | AOCRSS004 | AOCRSS005 | AOCRSS006 | AOCRSS007 | AOCRSS008 | AOCRSS009 | AOCRSS010 | AOCRSS011 | AOCRSS012 | AOCRSS013 | AOCRSS014 | AOCRSS015 | AOCRSS016 | AOCRSS017 | AOCRSS018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | SampleID | NDE133 | NDE134 | NDE135 | NDE136 | NDE137 | NDE138 | NDE139 | NDE140 | NDE141 | NDE142 | NDE144 | NDE145 | NDE146 | NDE147 | NDE148 | NDE149 | NDE150 | NDE151 |
| | | | | | | | | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 |
| | | | | | | | | 11/28/2000 10:40 | 11/28/2000 10:45 | 11/28/2000 11:10 | 11/28/2000 11:15 | 11/28/2000 12:35 | 11/28/2000 12:30 | 11/28/2000 12:45 | 11/28/2000 12:50 | 11/28/2000 13:15 | 11/28/2000 13:10 | 11/28/2000 14:00 | 11/28/2000 14:10 | 11/28/2000 14:20 | 11/28/2000 14:35 | 11/28/2000 14:40 | 11/28/2000 14:55 | 11/28/2000 15:00 | 11/29/2000 9:00 |
| **Metals** | | | | | | | | | | | | | | | | | | | | | | | | | |
| ALUMINUM | mg/kg | 28000 | | 100000 | 7610 | | | 14000 = - R | 26000 = - R | 9300 = - R | 21000 = - R | 11000 = - R | 10000 = - R | 11000 = - R | 16000 = - R | 18000 = - R | 14000 = - R | 24000 = - R | 19000 = - R | 15000 = - R | 21000 = - R | 26000 = - R | 24000 = - R | 18000 = - R | 17000 = - R |
| ANTIMONY | mg/kg | 2.3 | 5** | 40.9 | 3.13 | 5 | | 0.83 J | 1.7 J | 0.4 J | 1.5 J | 0.98 J | 0.9 J | 0.9 J | 0.8 J | 1.1 J | 1.3 J | 1.5 J | 1.8 J | 2.1 J | 1.2 J | 2.5 J | 2.8 J | 2.8 J | 0.99 J |
| ARSENIC | mg/kg | 2.2 | 18* | 1.6 | 0.39 | 29 | | 0.64 J - R | 1.2 J - R | 0.83 J - R | 0.32 U | 0.85 J - R | 0.33 U | 0.35 U | 0.59 J - R | 1.4 J - R | 1.4 J - R | 1.2 J - R | 1.8 J - I, R | 0.87 J - R | 1.9 J - I, R | 2.5 J | 1.8 J - I, R | 2 J - I, R | 1 J - R | 0.89 J - R |
| BARIUM | mg/kg | 320 | 330* | 6700 | 537 | 1800 | | 69 = | 87 = | 75 = | 51 = | 44 J | 25 J | 24 J | 32 J | 38 J | 47 = | 78 = | 51 = | 49 = | 59 = | 98 = | 75 = | 55 = | 82 = |
| BERYLLIUM | mg/kg | 0.45 | 10** | 190 | 15.4 | 63 | | 0.25 J | 0.36 J | 0.27 J | 0.21 J | 0.16 J | 0.19 J | 0.2 J | 0.2 J | 0.26 J | 0.24 J | 0.35 J | 0.23 J | 0.16 J | 0.18 J | 0.22 J | 0.24 J | 0.18 J | 0.12 J |
| CADMIUM | mg/kg | 0.04 | 32* | 45 | 3.7 | 8 | | 0.03 U | 0.033 U | 0.033 U | 0.03 U | 0.032 U | 0.03 U | 0.033 U | 0.031 U | 0.031 U | 0.03 U | 0.03 U | 0.028 U | 0.03 U | 0.032 U | 0.034 U | 0.033 U | 0.031 U | 0.03 U |
| CALCIUM | mg/kg | 210000 | | NA | NA | | | 26000 = | 38000 = | 5100 = | 8100 = | 8900 = | 6900 = | 11000 = | 9600 = | 20000 = | 30000 = | 36000 = | 55000 = | 13000 = | 8000 = | 8500 = | 11000 = | 16000 = | 17000 = |
| CHROMIUM, TOTAL | mg/kg | 74 | 0.4*** | 450 | 211 | 38 | | 19 J - E | 40 J - E, L | 9.6 J - E | 50 J - E, L | 21 J - E | 1.2 J - E | 2.9 J - E | 35 J - E | 32 J - E | 24 J - E | 36 J - E | 64 J - E, L | 33 J - E | 82 J - E, L | 70 J - E, L | 82 J - E, L | 12 J - E | 20 = - E |
| COBALT | mg/kg | 25 | 13* | 1900 | 903 | | | 12 = | 24 = - E | 9 J | 19 = - E | 9.5 J | 12 = | 11 J | 14 = - E | 14 = - E | 12 = | 22 = - E | 16 = - E | 14 = - E | 19 = - E | 26 = - E | 19 = - E | 8.5 J | 12 = |
| COPPER | mg/kg | 68 | 50*** | 4100 | 313 | | | 44 = | 96 = - E | 24 = | 100 = - E | 54 = - E | 80 = - E | 88 = - E | 52 = - E | 55 = - E | 45 = | 81 = - E | 67 = - E | 65 = - E | 69 = - E | 67 = - E | 77 = - E | 46 = | 66 = - E |
| IRON | mg/kg | 37531 | | 100000 | 2350 | | | 21000 = - R | 39000 = - R | 17000 = - R | 36000 = - R | 18000 = - R | 22000 = - R | 19000 = - R | 21000 = - R | 24000 = - R | 23000 = - R | 36000 = - R | 28000 = - R | 25000 = - R | 36000 = - R | 37000 = - R | 40000 = - R | 19000 = - R | 21000 = - R |
| MAGNESIUM | mg/kg | 12834 | | NA | NA | | | 6700 = | 19000 = | 2600 = | 19000 = | 5600 = | 5900 = | 8200 = | 7800 = | 12000 = | 9100 = | 18000 = | 14000 = | 7900 = | 8800 = | 7000 = | 7400 = | 2500 = | 8000 = |
| MANGANESE | mg/kg | 1167 | 100*** | 1945 | 176 | | | 580 = - E, R | 1000 = - E, R | 580 = - E, R | 590 = - E, R - | 480 = - E, R | 580 = - E, R | 520 = - E, R - | 430 = - E, R | 540 = - E, R | 580 = - E, R | 940 = - E, R | 680 = - E, R | 510 = - E, R | 510 = - E, R | 920 = - E, R | 530 = - E, R | 500 = - E, R | 570 = - E, R |
| LEAD | mg/kg | 6.9 | 120* | 750 | 400 | | | 14 J | 3.8 J | 2.8 J | 1.4 J | 4.1 J | 1.1 J | 2 J | 1.7 J | 150 J - E | 23 J | 3.6 J | 75 J | 7.6 J | 3.5 J | 18 J | 12 J | 11 J | 9 = |
| MERCURY | mg/kg | 0.031 | 0.1*** | 31 | 2.35 | | | 0.012 J | 0.017 J | 0.02 J | 0.0028 J | 0.013 J | 0.0028 U | 0.003 U | 0.0066 J | 0.0094 J | 0.014 J | 0.02 J | 0.0061 J | 0.013 J | 0.0068 J | 0.023 J | 0.053 = | 0.03 J | 0.013 J |
| NICKEL | mg/kg | 40 | 30** | 2043 | 156 | 130 | | 13 = | 29 = | 5.1 J | 28 = | 7.1 J | 1.7 J | 2.3 J | 22 = | 24 = | 14 = | 27 = | 26 = | 18 = | 31 = - E | 32 = - E | 31 = - E | 6 J | 14 = |
| POTASSIUM | mg/kg | 1700 | | NA | NA | | | 770 J | 800 J | 590 J | 640 J | 470 J | 360 J | 520 J | 390 J | 510 J | 700 J | 720 J | 790 J | 1100 = | 380 J | 660 J | 690 J | 730 J | 830 J |
| SELENIUM | mg/kg | 2 | 1** | 510 | 39.1 | 5 | | 0.8 J | 0.55 U | 0.56 U | 0.76 J | 0.74 J | 0.52 U | 0.56 U | 0.53 U | 0.64 J | 0.72 J | 0.51 U | 0.49 U | 0.86 J | 0.54 U | 0.57 U | 0.56 U | 0.53 U | 0.71 J |
| SODIUM | mg/kg | 6300 | | NA | NA | | | 590 J | 600 J | 92 J | 520 J | 510 J | 22 U | 69 J | 610 J | 360 J | 270 J | 550 J | 490 J | 310 J | 24 U | 34 J | 260 J | 200 J | 890 J |
| VANADIUM | mg/kg | 130 | 2** | 715 | 64.7 | 6000 | | 62 = - E, R | 100 = - E, R | 50 = - E | 100 = - E, R | 45 = - E | 57 = - E, R | 49 = - E | 72 = - E, R | 64 = - E, R | 57 = - E, R | 96 = - E, R | 79 = - E, R | 78 = - E, R | 120 = - E, R | 140 = - E, R | 140 = - E, R | 54 = - E | 61 = - E, R |
| ZINC | mg/kg | 65 | 50** | 100000 | 2346 | 12000 | | 45 = | 71 = - E | 28 = | 55 = - E | 45 = | 41 = | 39 = | 30 = | 46 = | 58 = - E | 64 = - E | 42 = | 63 = - E | 43 = | 44 = | 59 = - E | 43 = | 56 = - E |
| **Pesticides** | | | | | | | | | | | | | | | | | | | | | | | | | |
| p,p'-DDD | mg/kg | | | 9.95 | 2.44 | 16 | | 0.012 J | 0.004 U | 0.004 U | 0.0037 U | 0.0074 J | 0.0037 U | 0.004 U | 0.0008 J | 0.0021 J | 0.0022 J | 0.0035 J | 0.014 J | 0.0084 J | 0.0038 U | 0.0094 J | 0.004 U | 0.0038 U | 0.004 J |
| p,p'-DDE | mg/kg | | | 7 | 1.72 | 54 | | 0.046 = | 0.00068 J | 0.004 U | 0.0015 J | 0.043 = | 0.0037 U | 0.00095 J | 0.0011 J | 0.022 = | 0.048 = | 0.05 = | 0.083 = | 0.048 = | 0.0024 J | 0.057 = | 0.054 = | 0.01 = | 0.07 = |
| p,p'-DDT | mg/kg | | | 7 | 1.72 | 32 | | 0.034 J | 0.004 UJ | 0.004 UJ | 0.0007 J | 0.018 J | 0.0037 UJ | 0.004 UJ | 0.0005 J | 0.0076 J | 0.0092 J | 0.022 J | 0.098 R | 0.044 J | 0.0038 UJ | 0.032 = | 0.018 J | 0.0068 J | 0.034 = |
| **Semi-Volatiles** | | | | | | | | | | | | | | | | | | | | | | | | | |
| NAPHTHALENE | mg/kg | | | 19 | 5.59 | 84 | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.451 U | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.445 U |
| 2-METHYLNAPHTHALENE mg/kg | mg/kg | | | 409 | 31 | | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.451 U | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.445 U |
| ACENAPHTHYLENE | mg/kg | | | NA | NA | | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.451 U | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.151 J |
| ACENAPHTHENE | mg/kg | | 20** | 2921 | 368 | 570 | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.451 U | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.445 U |
| DIBENZOFURAN | mg/kg | | | 160 | 15 | | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.451 U | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.445 U |
| FLUORENE | mg/kg | | 30** | 2628 | 275 | 560 | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.451 U | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.445 U |
| PHENANTHRENE | mg/kg | | | NA | NA | | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.451 U | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.049 J |
| ANTHRACENE | mg/kg | | | 100000 | 2190 | 12000 | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.451 U | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.184 J |
| FLUORANTHENE | mg/kg | | | 2200 | 229 | 4300 | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.149 J | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.076 J | 0.758 = |
| PYRENE | mg/kg | | | 2812 | 232 | 4200 | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.164 J | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.115 J | 1.04 = |
| 3,3'-DICHLOROBENZIDINE mg/kg | mg/kg | | | 3.8 | 1.08 | 0.007 | | 0.913 U | 1.24 U | 1.2 U | 1.1 U | 1.11 U | 0.951 U | 0.996 U | 0.995 U | 0.816 U | 0.887 U | 0.903 U | 0.833 U | 0.895 U | 1.02 U | 1.05 U | 1.04 U | 1.02 U | 0.891 U |
| BENZO(a)ANTHRACENE | mg/kg | | | 2.1 | 0.62 | 2 | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.205 J | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.062 J | 0.569 = |
| CHRYSENE | mg/kg | | | 13 | 3.8 | 160 | | 0.086 J | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.264 J | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.078 J | 1.01 = |
| BENZO(b)FLUORANTHENE mg/kg | mg/kg | | | 2.1 | 0.62 | 5 | | 0.144 J | 0.619 U | 0.599 U | 0.55 U | 0.048 J | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.04 J | 0.399 J | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.093 J | 0.902 = - R |
| BENZO(k)FLUORANTHENE mg/kg | mg/kg | | | 21 | 6.21 | 49 | | 0.086 J | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.276 J | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.071 J | 0.755 = |
| BENZO(a)PYRENE | mg/kg | | | 0.21 | 0.06 | 8 | | 0.067 J - R | 0.619 U | 0.599 U | 0.55 U | 0.042 J | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.032 J | 0.288 J - I, R | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.075 J - R | 0.458 = - I, R |
| INDENO(1,2,3-c,d)PYRENE mg/kg | mg/kg | | | 2.1 | 0.62 | 14 | | 0.158 J | 0.619 U | 0.599 U | 0.55 U | 0.032 J | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.024 J | 0.288 J | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.068 J | 0.398 J |
| DIBENZ(a,h)ANTHRACENE mg/kg | mg/kg | | | 0.21 | 0.06 | 2 | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.062 J - R | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.163 J - R |
| BENZO(g,h,i)PERYLENE | mg/kg | | | NA | NA | | | 0.193 J | 0.619 U | 0.599 U | 0.55 U | 0.038 J | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.027 J | 0.263 J | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.066 J | 0.398 J |
| CARBAZOLE | mg/kg | | | 86 | 24.3 | 0.6 | | 0.457 U | 0.619 U | 0.599 U | 0.55 U | 0.555 U | 0.475 U | 0.498 U | 0.497 U | 0.408 U | 0.443 U | 0.451 U | 0.416 U | 0.447 U | 0.512 U | 0.527 U | 0.519 U | 0.512 U | 0.088 J |
| **Volatiles** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1,1-DICHLOROETHENE | mg/kg | | | 41 | 12.4 | 0.06 | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.019 U | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.01 U | 0.012 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U |
| METHYLENE CHLORIDE | mg/kg | | | 21 | 8.11 | 0.02 | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.019 U | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.01 U | 0.012 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U |
| TRICHLOROETHYLENE (TCE) mg/kg | mg/kg | | | 0.11 | 0.053 | 0.06 | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.00062 J | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.00029 J | 0.00036 J | 0.01 U | 0.0025 J | 0.0013 J | 0.01 U | 0.01 U |
| TOLUENE | mg/kg | | 200** | 520 | 520 | 12 | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.019 U | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.01 U | 0.012 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U |
| METHYL ISOBUTYL KETONE mg/kg | mg/kg | | | 4700 | 530 | | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.019 U | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.01 U | 0.012 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U |
| M,P-XYLENE (SUM OF ISOMERS) mg/kg | mg/kg | | | 420 | 27 | | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.019 U | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.01 U | 0.012 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U |
| O-XYLENE | mg/kg | | | 420 | 27 | | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.019 U | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.01 U | 0.012 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U |
| TETRACHLOROETHYLENE(PCE) mg/kg | mg/kg | | | 1.3 | 0.48 | 0.06 | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.019 U | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.01 U | 0.012 U | 0.01 U | 0.00027 J | 0.01 U | 0.01 U | 0.01 U |
| 2-HEXANONE | mg/kg | | | NA | NA | | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.019 U | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.01 U | 0.012 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U |
| XYLENES, TOTAL | mg/kg | | | 420 | 27.5 | 210 | | 0.01 U | 0.011 U | 0.011 U | 0.01 U | 0.019 U | 0.01 UJ | 0.015 U | 0.01 U | 0.01 UJ | 0.011 UJ | 0.012 U | 0.01 U | 0.012 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 U |

**Data Flags:**
U = Undetected; analyte was analyzed but not detected above the MDL. UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected. J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit. B = Analyte was detected in the associated method blank. R = Data was unusable.
Detected Value as shown
Exceeds regulatory screening criteria and (if applicable) background data
Exceeds regulatory screening criteria but does not exceed background data
**Screening Criteria**
PRG-I - Region IX Preliminary Remediation Goals - Industrial Soil (-I-)
PRG-R - Region IX Preliminary Remediation Goals - Residential Soil (-R-)
SSLD20 - Region IX Soil Screening Level (Migration to Ground Water - DAF 20) (-L-); The SSL values are provided for informational purposes only and a site-specific DAF will be calculated using data collected during the RI.
BKG -Background Values, NASD Background Analysis (CH2M Hill, June 2001)
ECO References (-E-)
* U.S. EPA Office of Emergency and Remedial Response, Draft Ecological Soil Screening Level Guidance, March 2005.
** Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. Toxicological benchmarks for screening contaminants of potential concern for effects on terrestrial plants: 1997 revision. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-95/R3.
*** Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997b. Toxicological benchmarks for screening contaminants of potential concern for effects on soil and litter invertebrates and heterotrophic process: 1997 revision. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-126/R2.

Table 2-2
Surface Soil Analytical Data Detection Summary
AOC R, NASD, Vieques, PR

| StationID | | | | | | | StationID | AOCRSS019 | AOCRSS020 | AOCRSS021 | AOCRSS022 | AOCRSS023 | AOCRSS024 | AOCRSS025 | AOCRSS026 | AOCRSS027 | AOCRSS028 | AOCRSS029 | AOCRSS030 | AOCRSS031 | AOCRSS032 | AOCRSS033 | AOCRSS034 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SampleID | | | | | | | SampleID | NDE152 | NDE153 | NDE155 | NDE156 | NDE157 | NDE158 | NDE159 | NDE160 | NDE161 | NDE162 | NDE163 | NDE164 | NDE166 | NDE167 | NDE168 | NDE169 |
| Collection Depth | | | | 2005 | 2005 | | Collection Depth | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 | 0 To 0.5 |
| Date Collected | | | 2005 | PRG-I | PRG-R | 2005 | Date Collected | 11/29/2000 9:35 | 11/29/2000 9:40 | 11/29/2000 10:30 | 11/29/2000 10:25 | 11/29/2000 10:40 | 11/29/2000 11:10 | 12/01/2000 14:25 | 12/01/2000 14:35 | 12/01/2000 15:05 | 12/01/2000 15:10 | 12/01/2000 14:55 | 12/01/2000 14:45 | 12/01/2000 14:30 | 12/01/2000 14:37 | 12/01/2000 14:20 | 12/01/2000 14:50 |
| Parameter | Units | BKG | ECO - ss | 1E-6) | (HI=0.1, risk 1E-6) | SSLD20 | | | | | | | | | | | | | | | | | |
| **Metals** | | | | | | | | | | | | | | | | | | | | | | | |
| ALUMINUM | mg/kg | 29000 | | 100000 | 7610 | | | 11000 = - R - | 11000 = - R - | 10000 = - R - | 11000 = - R - | 10000 = - R - | 17000 = - R - | 3600 = | 5900 = | 12000 = - R - | 4000 = | 5000 = | 6500 = | 7800 = - R - | 6600 = | 5100 = | 7500 = |
| ANTIMONY | mg/kg | 2.3 | 5** | 40.9 | 3.13 | 5 | | 0.76 J | 0.92 J | 1.6 J | 0.92 J | 0.76 J | 1.1 J | 0.26 UJ | 0.39 J | 0.82 J | 0.26 UJ | 0.31 UJ | 0.61 J | 0.61 J | 0.4 J | 0.35 J | 0.87 J |
| ARSENIC | mg/kg | 2.2 | 18* | 1.6 | 0.39 | 29 | | 0.32 U | 0.81 J - R - | 0.86 J - R - | 0.55 J - R - | 6.3 = - I, R - | 0.32 U | 0.32 U | 0.91 J - R - | 1.2 J - R - | 0.31 U | 0.37 U | 15 = - I, R - | 3.6 = - I, R - | 0.75 J - R - | 0.31 U | 0.74 J - R - |
| BARIUM | mg/kg | 320 | 330* | 6700 | 537 | 1600 | | 51 = | 54 = | 34 J | 48 = | 48 = | 47 = | 55 = | 54 = | 85 = | 38 J | 85 = | 52 = | 60 = | 62 = | 59 = | 52 = |
| BERYLLIUM | mg/kg | 0.45 | 10** | 190 | 15.4 | 63 | | 0.13 J | 0.17 J | 0.038 U | 0.037 U | 0.035 U | 0.18 J | 0.036 U | 0.037 U | 0.29 J | 0.036 U | 0.14 J | 0.19 J | 0.21 J | 0.17 J | 0.12 J | 0.17 J |
| CADMIUM | mg/kg | 0.04 | 32* | 45 | 3.7 | 8 | | 0.03 U | 0.03 U | 0.031 U | 0.03 U | 0.029 U | 0.03 U | 0.029 U | 0.03 U | 0.031 U | 0.029 U | 0.034 U | 0.029 U | 0.18 J | 0.032 U | 0.029 U | 0.032 U |
| CALCIUM | mg/kg | 210000 | | NA | NA | | | 9100 = | 16000 = | 6800 = | 19000 = | 6500 = | 6400 = | 2500 = | 10000 = | 39000 = | 1900 = | 3200 = | 17000 = | 37000 = | 5100 = | 4300 = | 4100 = |
| CHROMIUM, TOTAL | mg/kg | 74 | 0.4*** | 450 | 211 | 38 | | 15 = - E - | 20 = - E - | 18 = - E - | 25 = - E - | 3.8 = - E - | 51 = - E, L - | 4 J - E - | 7.5 J - E - | 10 J - E - | 2.5 J - E - | 4.1 J - E - | 10 J - E - | 12 J - E - | 9.1 J - E - | 5.5 J - E - | 38 J - E - |
| COBALT | mg/kg | 25 | 13* | 1900 | 903 | | | 10 J | 10 J | 12 = | 10 J | 13 = | 21 = - E - | 5 J | 6.7 J | 9.1 J | 4.8 J | 7 J | 7.5 J | 8 J | 7.7 J | 6.6 J | 7.2 J |
| COPPER | mg/kg | 88 | 50*** | 4100 | 313 | | | 40 = | 41 = | 59 = - E - | 46 = | 98 = - E - | 72 = - E - | 12 J | 21 J | 30 J | 12 J | 20 J | 26 = | 29 = | 26 = | 19 = | 18 = |
| IRON | mg/kg | 37531 | | 100000 | 2350 | | | 19000 = - R - | 19000 = - R - | 20000 = - R - | 18000 = - R - | 25000 = - R - | 30000 = - R - | 9700 = - R - | 21000 = - R - | 20000 = - R - | 9800 = - R - | 12000 = - R - | 13000 = - R - | 16000 = - R - | 15000 = - R - | 13000 = - R - | 14000 = - R - |
| MAGNESIUM | mg/kg | 12834 | | NA | NA | | | 5700 = | 5800 = | 6200 = | 8800 = | 6500 = | 11000 = | 1200 = | 2100 = | 3800 = | 1000 B | 1500 = | 2600 = | 3700 = | 2400 = | 1600 = | 1500 = |
| MANGANESE | mg/kg | 1167 | 100*** | 1945 | 176 | | | 570 = - E, R - | 580 = - E, R - | 510 = - E, R - | 600 = - E, R - | 630 = - E, R - | 600 = - E, R - | 440 = - E, R - | 630 = - E, R - | 630 = - E, R - | 420 = - E, R - | 680 = - E, R - | 520 = - E, R - | 550 = - E, R - | 620 = - E, R - | 580 = - E, R - | 610 = - E, R - |
| LEAD | mg/kg | 6.9 | 120* | 750 | 400 | | | 5.3 = | 5.2 = | 12 = | 19 = | 1.8 = | 0.18 U | 3 J | 7.2 J | 14 J | 6.2 J | 3.8 J | 20 = | 33 = | 11 = | 5.8 = | 3.7 = |
| MERCURY | mg/kg | 0.031 | 0.1*** | 31 | 2.35 | | | 0.015 J | 0.011 J | 0.011 J | 0.01 J | 0.0027 U | 0.0058 J | 0.0038 J | 0.011 J | 0.011 J | 0.012 J | 0.021 UJ | 0.018 J | 0.021 J | 0.016 J | 0.01 J | 0.016 J |
| NICKEL | mg/kg | 40 | 30** | 2043 | 156 | 130 | | 9.5 = | 12 = | 12 = | 16 = | 3.2 J | 30 = | 2.2 J | 4.6 J | 5.2 J | 1.5 J | 2.7 J | 5.2 J | 6.8 J | 5.5 J | 2.9 J | 7.9 J |
| POTASSIUM | mg/kg | 1700 | | NA | NA | | | 650 J | 680 J | 470 J | 690 J | 930 J | 570 J | 760 J | 840 J | 1100 J | 650 J | 900 J | 750 J | 1100 J | 580 J | 750 J | 970 J |
| SELENIUM | mg/kg | 2 | 1** | 510 | 39.1 | 5 | | 0.82 J | 0.95 J | 1.4 J - E - | 0.97 J | 1.1 J - E - | 0.99 J | 0.71 J | 1.6 J - E - | 1.2 J - E - | 0.88 J | 0.59 U | 0.5 U | 0.55 U | 0.55 U | 0.49 U | 1.3 = - E - |
| SODIUM | mg/kg | 8300 | | NA | NA | | | 140 J | 220 J | 110 J | 300 J | 21 U | 240 J | 41 J | 110 J | 430 J | 27 J | 52 J | 210 J | 450 J | 99 J | 96 J | 140 J |
| VANADIUM | mg/kg | 130 | 2** | 715 | 54.7 | 6000 | | 57 = - E, R - | 59 = - E, R - | 56 = - E, R - | 50 = - E - | 57 = - E, R - | 110 = - E, R - | 29 J - E - | 36 J - E - | 54 J - E - | 28 J - E - | 32 J - E - | 40 = - E - | 42 = - E - | 42 = - E - | 38 = - E - | 42 = - E - |
| ZINC | mg/kg | 65 | 50** | 100000 | 2346 | 12000 | | 40 = | 40 = | 80 = - E - | 43 = | 65 = - E - | 46 = | 20 J | 36 J | 42 J | 19 J | 25 J | 42 = | 63 = - E - | 36 = | 28 = | 23 = |
| **Pesticides** | | | | | | | | | | | | | | | | | | | | | | | |
| p,p'-DDE | mg/kg | | | 9.95 | 2.44 | 16 | | 0.018 = | 0.048 J | 0.328 = | 0.045 = | 0.161 = | 0.0037 U | 0.0036 U | 0.019 J | 0.0094 J | 0.001 J | 0.0042 U | 0.093 J | 0.076 J | 0.157 J | 0.0049 J | 0.006 J |
| p,p'-DDD | mg/kg | | | 7 | 1.72 | 54 | | 0.0037 U | 0.0037 U | 0.019 = | 0.0037 U | 0.0035 U | 0.0037 U | 0.0036 U | 0.0037 U | 0.0077 UJ | 0.0035 UJ | 0.0042 U | 0.0038 UJ | 0.004 UJ | 0.0039 UJ | 0.0038 UJ | 0.0039 UJ |
| p,p'-DDT | mg/kg | | | 7 | 1.72 | 32 | | 0.012 = | 0.032 J | 0.111 J | 0.046 = | 0.042 = | 0.0037 U | 0.0036 U | 0.0089 J | 0.0087 J | 0.0035 J | 0.0042 U | 0.082 J | 0.089 J | 0.054 J | 0.0036 J | 0.0039 UJ |
| **Semi-Volatiles** | | | | | | | | | | | | | | | | | | | | | | | |
| NAPHTHALENE | mg/kg | | | 19 | 5.59 | 84 | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.526 U | 0.834 = | 0.468 U | 0.623 U | 0.482 UJ | 0.587 UJ | 0.509 UJ | 0.448 UJ | 0.51 UJ |
| 2-METHYLNAPHTHALENE | mg/kg | | | 409 | 31 | | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.526 U | 1.13 = | 0.468 U | 0.623 U | 0.482 UJ | 0.587 UJ | 0.509 UJ | 0.448 UJ | 0.51 UJ |
| ACENAPHTHYLENE | mg/kg | | | NA | NA | | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.165 J | 0.69 = | 0.468 U | 0.623 U | 0.331 J | 0.134 J | 0.509 UJ | 0.448 UJ | 0.51 UJ |
| ACENAPHTHENE | mg/kg | | 20** | 2821 | 388 | 570 | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.526 U | 1.04 = | 0.468 U | 0.623 U | 0.482 UJ | 0.587 UJ | 0.509 UJ | 0.448 UJ | 0.51 UJ |
| DIBENZOFURAN | mg/kg | | | 160 | 15 | | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.526 U | 1.01 = | 0.468 U | 0.623 U | 0.482 UJ | 0.587 UJ | 0.509 UJ | 0.448 UJ | 0.51 UJ |
| FLUORENE | mg/kg | | 30*** | 2628 | 275 | 560 | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.526 U | 0.965 = | 0.468 U | 0.623 U | 0.482 UJ | 0.587 UJ | 0.509 UJ | 0.448 UJ | 0.51 UJ |
| PHENANTHRENE | mg/kg | | | NA | NA | | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.046 J | 4.4 = | 0.468 U | 0.623 U | 0.093 J | 0.044 J | 0.509 UJ | 0.448 UJ | 0.079 J |
| ANTHRACENE | mg/kg | | | 100000 | 2190 | 12000 | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.14 J | 1.23 = | 0.468 U | 0.623 U | 0.299 J | 0.107 J | 0.03 J | 0.448 UJ | 0.51 UJ |
| FLUORANTHENE | mg/kg | | | 2200 | 229 | 4300 | | 0.031 J | 0.044 J | 0.112 J | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.747 = | 6.82 = | 0.146 J | 0.06 J | 1.54 J | 0.75 J | 0.21 J | 0.129 J | 0.792 J |
| PYRENE | mg/kg | | | 2912 | 232 | 4200 | | 0.047 J | 0.046 J | 0.094 J | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.862 = | 9.79 = | 0.159 J | 0.082 J | 1.8 J | 1.03 J | 0.256 J | 0.151 J | 0.72 J |
| 3,3'-DICHLOROBENZIDINE | mg/kg | | | 3.8 | 1.08 | 0.007 | | 0.895 U | 0.841 U | 0.872 U | 0.838 U | 0.789 U | 0.896 U | 0.839 U | 0.049 J - L - | 0.989 U | 0.936 U | 1.25 U | 0.964 UJ | 1.17 UJ | 1.02 UJ | 0.891 UJ | 1.02 UJ |
| BENZO(a)ANTHRACENE | mg/kg | | | 2.1 | 0.62 | 2 | | 0.035 J | 0.031 J | 0.048 J | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.861 = - R - | 5.23 = - I, R, L - | 0.087 J | 0.052 J | 2.17 J - I, R, L - | 0.793 J - R - | 0.164 J | 0.131 J | 0.16 J |
| CHRYSENE | mg/kg | | | 13 | 3.8 | 160 | | 0.061 J | 0.069 J | 0.091 J | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 1.18 = | 6.5 R | 0.116 J | 0.077 J | 2.64 J | 1.11 J | 0.303 J | 0.223 J | 0.494 J |
| BENZO(b)FLUORANTHENE | mg/kg | | | 2.1 | 0.62 | 5 | | 0.06 J | 0.069 J | 0.078 J | 0.419 U | 0.394 U | 0.448 U | 0.025 J | 1.91 = - R - | 8.82 = - I, R, L - | 0.115 J | 0.078 J | 3.78 J - I, R - | 1.38 J - R - | 0.44 J | 0.27 J | 0.313 J |
| BENZO(k)FLUORANTHENE | mg/kg | | | 21 | 6.21 | 49 | | 0.051 J | 0.07 J | 0.09 J | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 1.01 = | 4.75 = | 0.11 J | 0.074 J | 2.73 J | 1.25 J | 0.278 J | 0.196 J | 0.265 J |
| BENZO(a)PYRENE | mg/kg | | | 0.21 | 0.06 | 8 | | 0.036 J | 0.056 J | 0.062 J - R - | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 1.13 = - I, R - | 4.93 = - I, R - | 0.081 J - R - | 0.057 J | 2.04 J - I, R - | 1 J - I, R - | 0.26 J - I, R - | 0.182 J - R - | 0.2 J - R - |
| INDENO(1,2,3-c,d)PYRENE | mg/kg | | | 2.1 | 0.62 | 14 | | 0.037 J | 0.059 J | 0.04 J | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.403 J | 1.52 = - R - | 0.024 J | 0.623 U | 0.755 J - R - | 0.39 J | 0.109 J | 0.184 J | 0.193 J |
| DIBENZ(a,h)ANTHRACENE | mg/kg | | | 0.21 | 0.06 | 2 | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.133 J - R - | 0.565 = - I, R - | 0.468 U | 0.623 U | 0.224 J - I, R - | 0.083 J - R - | 0.509 UJ | 0.044 J | 0.035 J |
| BENZO(g,h,i)PERYLENE | mg/kg | | | NA | NA | | | 0.039 J | 0.07 J | 0.04 J | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.334 J | 1.21 = | 0.468 U | 0.623 U | 0.515 J | 0.276 J | 0.09 J | 0.162 J | 0.17 J |
| CARBAZOLE | mg/kg | | | 86 | 24.3 | 0.6 | | 0.447 U | 0.42 U | 0.436 U | 0.419 U | 0.394 U | 0.448 U | 0.42 U | 0.067 J | 0.561 = | 0.468 U | 0.623 U | 0.16 J | 0.051 J | 0.509 UJ | 0.448 UJ | 0.098 J |
| **Volatiles** | | | | | | | | | | | | | | | | | | | | | | | |
| 1,1-DICHLOROETHENE | mg/kg | | | 41 | 12.4 | 0.06 | | 0.01 U | 0.01 U | 0.01 UJ | 0.01 UJ | 0.01 UJ | 0.00047 J | 0.01 U | 0.00042 J | 0.00043 J | 0.01 UJ | 0.00085 J | 0.01 UJ | 0.00074 J | 0.00051 J | 0.01 U | 0.011 UJ |
| METHYLENE CHLORIDE | mg/kg | | | 21 | 9.11 | 0.02 | | 0.01 U | 0.01 U | 0.01 UJ | 0.01 UJ | 0.01 UJ | 0.01 U | 0.00048 J | 0.01 U | 0.01 U | 0.01 UJ | 0.01 U | 0.01 UJ | 0.012 UJ | 0.01 UJ | 0.01 U | 0.011 UJ |
| TRICHLOROETHYLENE (TCE) | mg/kg | | | 0.11 | 0.053 | 0.06 | | 0.01 U | 0.01 U | 0.01 UJ | 0.01 UJ | 0.01 UJ | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 UJ | 0.01 U | 0.01 UJ | 0.012 UJ | 0.01 UJ | 0.01 U | 0.011 UJ |
| TOLUENE | mg/kg | | 200** | 520 | 520 | 12 | | 0.01 U | 0.01 U | 0.01 UJ | 0.01 UJ | 0.01 UJ | 0.01 U | 0.00027 J | 0.00024 J | 0.01 U | 0.0011 J | 0.00059 J | 0.01 UJ | 0.012 UJ | 0.01 UJ | 0.01 U | 0.011 UJ |
| METHYL ISOBUTYL KETONE | mg/kg | | | 4700 | 530 | | | 0.01 U | 0.01 U | 0.01 UJ | 0.01 UJ | 0.0015 J | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 UJ | 0.01 U | 0.01 UJ | 0.012 UJ | 0.01 UJ | 0.01 U | 0.011 UJ |
| M,P-XYLENE (SUM OF ISOMERS) | mg/kg | | | 420 | 27 | | | 0.01 U | 0.00035 J | 0.01 UJ | 0.01 UJ | 0.01 UJ | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 UJ | 0.01 U | 0.00042 J | 0.012 UJ | 0.01 UJ | 0.01 U | 0.011 UJ |
| O-XYLENE | mg/kg | | | 420 | 27 | | | 0.01 U | 0.01 U | 0.01 UJ | 0.01 UJ | 0.01 UJ | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 UJ | 0.01 U | 0.01 J | 0.012 UJ | 0.01 UJ | 0.01 U | 0.011 UJ |
| TETRACHLOROETHYLENE(PCE) | mg/kg | | | 1.3 | 0.48 | 0.06 | | 0.01 U | 0.01 U | 0.01 UJ | 0.01 UJ | 0.01 UJ | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 UJ | 0.01 U | 0.01 UJ | 0.012 UJ | 0.01 UJ | 0.01 U | 0.011 UJ |
| 2-HEXANONE | mg/kg | | | NA | NA | | | 0.01 U | 0.01 U | 0.01 UJ | 0.01 UJ | 0.01 UJ | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.00067 J | 0.01 UJ | 0.0011 J | 0.01 UJ | 0.012 UJ | 0.01 U | 0.011 UJ |
| XYLENES, TOTAL | mg/kg | | | 420 | 27.5 | 210 | | 0.01 U | 0.00035 J | 0.01 UJ | 0.01 UJ | 0.01 UJ | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.01 UJ | 0.01 U | 0.00059 J | 0.012 UJ | 0.01 UJ | 0.01 U | 0.011 UJ |

**Data Flags:**
U = Undetected; analyte was analyzed but not detected above the MDL. UJ = Detection limit was estimated; analyte was analyzed and qualified as undetected. J = Estimated value; compounds detected at concentrations between the reporting limit and the method detection limit. B = Analyte was detected in the associated method blank. R = Data was unusable.
Detected Value as shown
Exceeds regulatory screening criteria and (if applicable) background data
Exceeds regulatory screening criteria but does not exceed background data

**Screening Criteria**
PRG-I - Region IX Preliminary Remediation Goals - Industrial Soil **(-I-)**
PRG-R - Region IX Preliminary Remediation Goals - Residential Soil **(-R-)**
SSLD20 - Region IX Soil Screening Level (Migration to Ground Water - DAF 20) (-L-); The SSL values are provided for informational purposes only and a site-specific DAF will be calculated using data collected during the RI.
BKG -Background Values, NASD Background Analysis (CH2M Hill, June 2001)
ECO References **(-E-)**
* U.S. EPA Office of Emergency and Remedial Response, Draft Ecological Soil Screening Level Guidance, March 2005,
** Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. Toxicological benchmarks for screening contaminants of potential concern for effects on terrestrial plants: 1997 revision. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-85/R3.
*** Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997b. Toxicological benchmarks for screening contaminants of potential concern for effects on soil and litter invertebrates and heterotrophic process: 1997 revision. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-126/R2.


Soure: 1967 Aerial, Contours U.S. Geological 7.5 Minutes Quadrangle map of Vieques Island, Puerto Rico. Map updated 1982

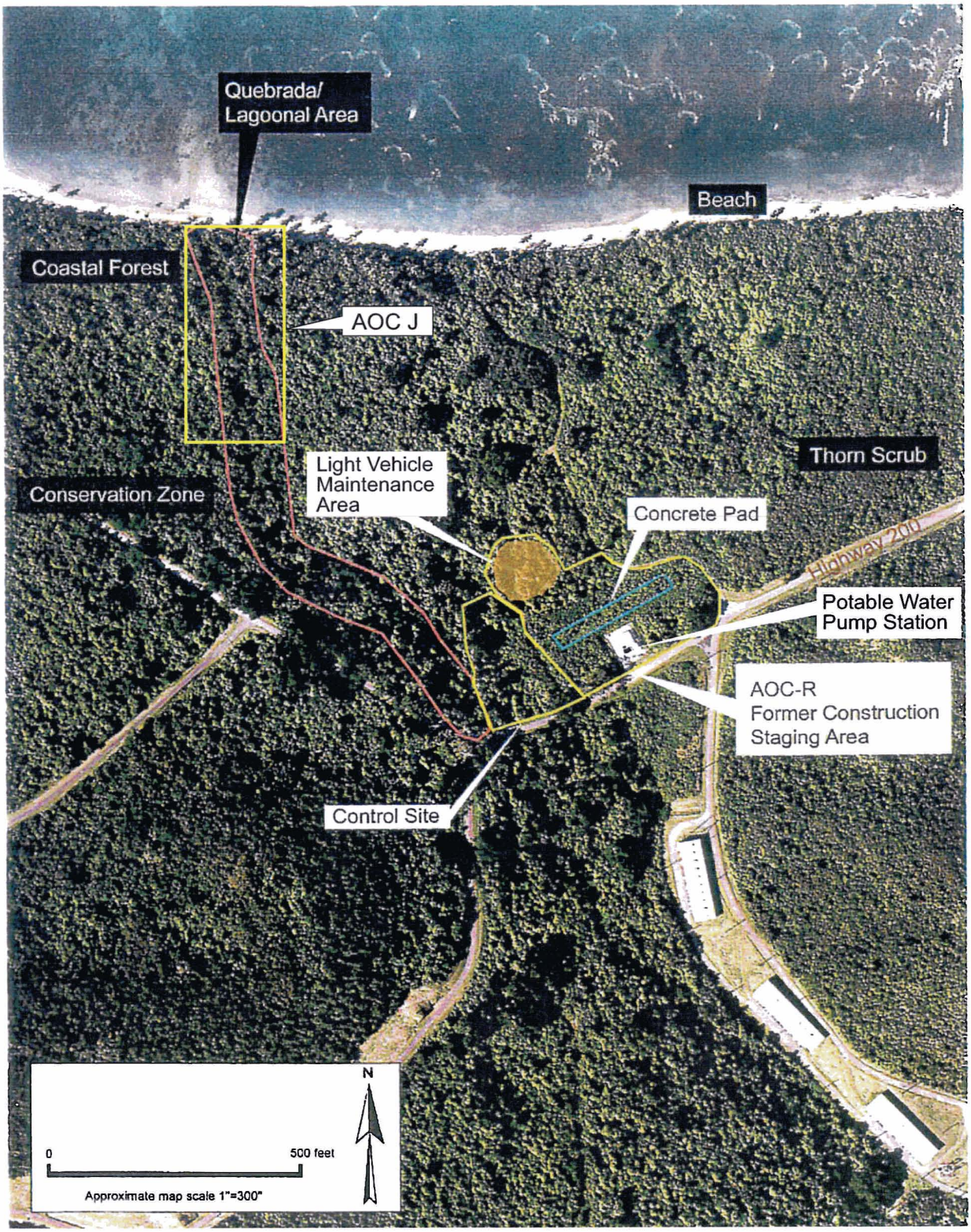
**Legend**

- Access Restriction Boundary
- 1 Meter Contours
- 10 Meter Contours

**Figure 2-1**
**Topographic Map, AOC R**
*Former NASD, Vieques, Puerto Rico*

CH2MHILL

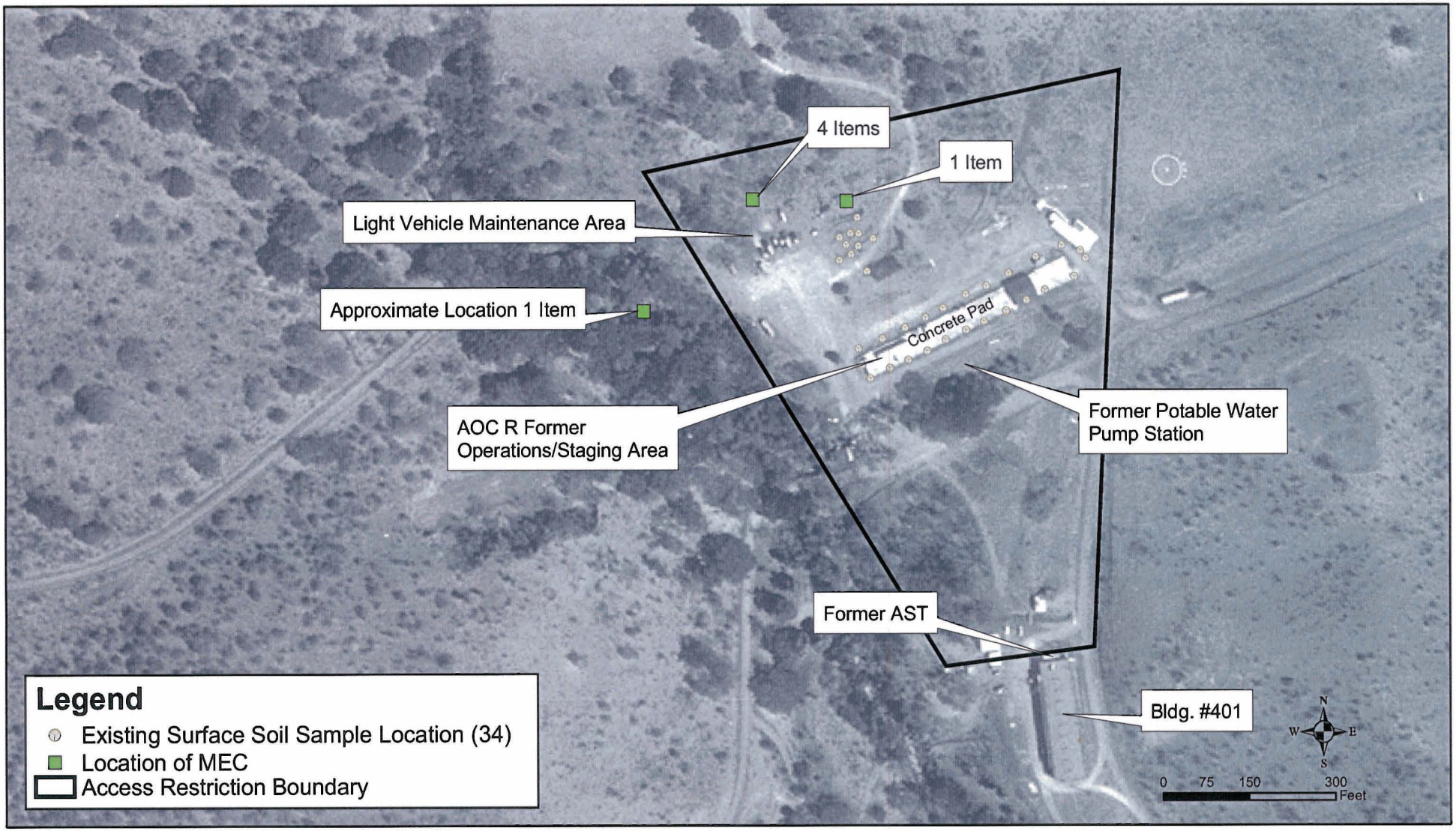
File Path: \\tampa\projects\Environmental\180357 RIFS for AOCs I, R NASD Vieques\GIS\AOC R topo map.mxd, Date: 07 01, 2004, User: gperdew




Source: 1999 aerial photograph

**Figure 2-2**
**Location of AOC R, Former Construction Staging Area Site within the Former NASD, Puerto Rico**
*Former NASD, Vieques, Puerto Rico*
*Source: Expanded PA/SI Seven Sites report, 2002*

**Figure 2-3**
**AOC R Site Photograph of Partial Vine-Covered Concrete Pad Looking East**
*Former NASD, Vieques, Puerto Rico*
*Source: Expanded PA/SI Seven Sites report, 2002*

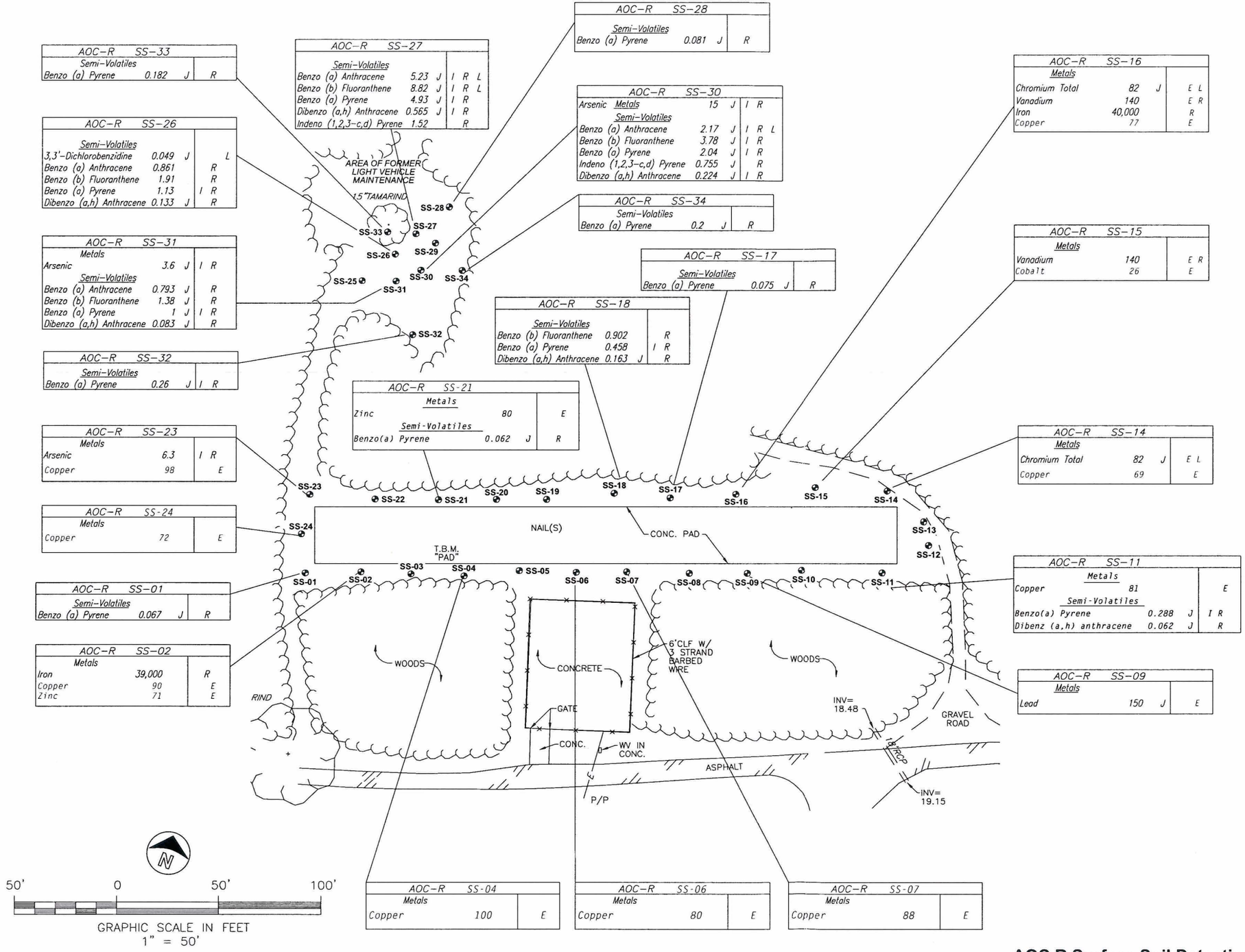



Source: 1967 Aerial

**Figure 2-4**
**MEC Item Locations in Vicinity of AOC R**
*Former NASD, Vieques, Puerto Rico*

CH2MHILL

File Path: \\topaz\gis\Proj\Vieques\AOC R AOC R MEC LocationsFIG 2-4.mxd, Date: 09/16/05. User pcooney.




## LEGEND

SURFACE/SUBSURFACE SOIL ◕ SS-01

CONCENTRATIONS IN MILLIGRAMS PER KILOGRAMS **mg/kg**

J - ESTIMATED VALUE; COMPOUNDS DETECTED AT CONCENTRATIONS BETWEEN THE REPORTING LIMIT AND THE METHOD DETECTION LIMIT.

## SCREENING CRITERIA

I - EXCEEDS INDUSTRIAL PRG

L - EXCEEDS REGION IX SOIL SCREENING LEVELS FOR MIGRATION TO GROUNDWATER

R - EXCEEDS RESIDENTIAL PRG

E - EXCEEDS ECOLOGICAL SCREENING CRITERION

**Figure 2-5**
**AOC R Surface Soil Detections Above Screening Criteria and Background**
*Former NASD, Vieques, Puerto Rico*

SECTION 4

# RI Technical Approach and Investigation Procedures

This section summarizes the proposed sampling, technical approach, and investigation methodologies that will be used to perform RI activities for AOC R. Details regarding field sampling procedures and health and safety requirements are addressed in the facility-wide Master Work Plan for the Former NASD (CH2M HILL, 2001). Table 4-1 summarizes site sampling conducted in the past, and previously discussed in Section 2.

## 4.1 Data Quality Objectives

Previously collected data from the Expanded PA/SI and data collected as part of this RI sampling effort will be used for site characterization, risk assessment, and remedial action alternative evaluations, if necessary. These data quality objectives (DQOs) require a high level of quality assurance/quality control (QA/QC). Appropriate QA/QC samples will be collected during the RI, and the samples will be analyzed at a fixed base laboratory that fulfills the requirements of the U.S. Navy's QA/QC Program Manual and the USEPA's Contract Laboratory Program (CLP) and applicable SW846 methods.

AOC R includes several different areas for investigation. These comprise the concrete footprint of an old public works building (demolished), construction staging area, vehicle maintenance area, a former AST located nearby, south of Highway 200, and an ephemeral stream adjacent to the site. The PA/SI included surface soil sampling around the concrete pad of the former building at this site and at the vehicle maintenance area. The PA/SI analytical results indicated several metals and SVOCs were present in surface soil above human health and/or ecological screening criteria. No subsurface soil samples or groundwater samples were previously collected for AOC R. Additionally, an area identified as the probable location of a former AST, several MEC items, and a debris area identified during 2004 have been added to the area of investigation for AOC R. It is assumed the AST was located just north of Building 401 where two concrete saddles are present.

This work plan includes sampling that not only will provide further delineation of the extent of the polynuclear aromatic hydrocarbons (PAHs) and metals detected previously above screening criteria, but will include samples and analyses that provide a more comprehensive understanding of the nature and extent of contamination in all site media. To that end, all samples collected during the RI will be analyzed for the Target Analyte List/Target Compound List (TAL/TCL) constituents plus explosives suite. The media identified for sampling also have been expanded to include surface water and sediment from the ephemeral stream in addition to surface soil, subsurface soil, and groundwater.

The sampling activities proposed for AOC R include:

- Surface and subsurface soil sampling in the potential source areas and in the vicinity of previously collected samples to develop an understanding of the nature and extent of contamination in soil
- Surface water and sediment sampling in the ephemeral stream to determine whether runoff from potential sources areas has adversely affected these media
- Sampling of the groundwater following installation of monitoring wells in potential source areas to develop and understanding of whether potential releases from primary or secondary sources have adversely affected the groundwater quality.

# 4.2 Field Investigation

This section describes the field activities to be conducted for the RI at AOC R. The RI component of the program consists of the installation and sampling of monitoring wells to determine the extent of groundwater contamination and the collection and analysis of surface and subsurface soils to further define the extent of contamination at the site. In addition sediment and surface water samples will be collected in the adjacent ephemeral stream. These tasks are described in the following subsections.

## 4.2.1 Brush Clearance

Prior to conducting the RI, vegetation removal may be required in areas proposed for sampling. In anticipation of the vegetation removal, a threatened and endangered species survey will be done in coordination with the United States Fish and Wildlife Service (USFWS). Following completion of the threatened and endangered species survey and discussion with USFWS, a brush clearing team will be contracted to remove overgrown vegetation at AOC R to facilitate MEC removal, monitoring well installation, and soil sampling.

## 4.2.2 Munitions Identification, Removal and Avoidance Survey

A qualified MEC Contractor will inspect the three locations where MEC items have been identified in the vicinity of AOC R and characterize the MEC items. An MEC Information Form 2-1 shown in Table 4-2 will be filled out for each munitions item identified. An MEC Technician will carefully remove enough soil, without disturbing the munitions item, to facilitate positive identification or to obtain identification features. The MEC technician will make every effort to identify munitions through visual examination of the item for markings and other identifying features such as shape, size, and external fittings. Items will not be moved during the inspection/identification until the fuze condition can be ascertained. If the condition is questionable, the fuze will be considered armed. The MEC Contractor will provide positive identification of the item and the necessary means of disposition of the item before implementing any disposal operations.

The MEC contractor will carefully inspect the three locations where MEC has been identified with the aid of an appropriate geophysical instrument. If the munitions items located are safe to move, they will be relocated to a consolidated holding/disposal area for treatment by detonation. However, should the munitions items be unsafe to move, the MEC Contractor will treat these items using blow-in-place (BIP) methods by destroying the item with an explosive charge that will be detonated. When necessary, engineering controls or protective measures will

be employed to minimize damage from BIP operations. These controls may consist of earthen works, sandbags, trenching, buttressing, taping of glass, mounding, flooding, and venting to reduce the damaging effects of detonation.

All explosive disposal operations will be performed under the direction and supervision of the MEC Contractor. During these operations, the contractor's onsite Unexploded Ordnance (UXO) Safety Officer will closely monitor these operations, strictly enforce safety and adherence to procedures, and ensure that the exclusion area is appropriately evacuated. The safety requirements are provided in the Explosive Safety Submission (ESS) for the site.

A restricted/exclusion zone (EZ) shall be established around the area where BIP operations are conducted. While BIP operations are in progress, only those personnel necessary for the operation will be allowed within the EZ. If nonessential personnel enter the area, all BIP operations will cease.

Disposal of MEC, ordinance related scrap (ORS), and non-ORS is described in greater detail in Appendix G.

An avoidance survey will be conducted within the debris areas at AOC R, in the vicinity of where the munitions items were identified. The appropriate geophysical technique will be employed to identify the potential presence of other munitions items. If geophysical anomalies are identified, additional munitions identification and clearance activities will be conducted.

In addition to the above, an engineering evaluation/cost analysis (EE/CA) has been prepared for removal of debris located at AOC R. Removal of the debris may be conducted during the course of the investigation, or following evaluation of the RI data.

### 4.2.3 Monitoring Well Installation, Sampling, and Testing

Seven new monitoring wells will be installed at AOC R. All sample locations and monitoring well elevations will be surveyed in accordance with the Civil Surveying SOP included in the Master Work Plan. Monitoring wells will be installed using the hollow stem auger method or air rotary to advance the soil borings. In addition, split spoon sampling will be conducted to document lithology. Monitoring well locations are shown in Figure 4-1. The rationale for the monitoring well location selection is as follows:

- Monitoring well NDARMW01 will be installed upgradient of the area for use in site-specific background comparisons.
- Monitoring well NDARMW02 will be installed just north (directly downgradient) of the former AST location to assess groundwater impacts from this activity.
- Monitoring wells NDARMW03 and NDARMW04 will be located within approximately 10 feet north of the concrete pad along Highway 200 to provide data downgradient of the concrete pad.
- Monitoring well NDARMW05 will be installed approximately in the center of the vehicle maintenance area.
- Monitoring well NDARMW06 will be installed downgradient of the vehicle maintenance area to assess groundwater impacts from this activity.

- Monitoring well NDARMW07 will be installed within 10 feet, in the downgradient direction, of where soil samples were collected during the PA/SI.

Soils from monitoring well locations MW-1, MW-3, and MW-6 will be continuously logged to bedrock using split spoon samplers. If the saturated zone is not detected in the unconsolidated zone, continuous rock coring will be attempted to the total depth of the three wells in bedrock. The soil at all other boring/well locations will be sampled at 5-ft intervals by split spoon to bedrock, then air rotary to the total depth of the boring/well if the saturated zone is not detected in the unconsolidated zone. All soil collected will be lithologically described and screened with a PID for the presence of volatile constituents. If contamination is suspected based on visual observation or PID readings, a sample will be collected for analysis in accordance with the site analytical protocol.

Continuous 2- or 4-inch-diameter core samples will be collected from three monitoring well locations using 5- or 10-ft core barrels with the minimal amount of water required. Cores will be photographed, described in the field by a geologist including fractures, weathering, rock type, bedding, joints, etc. Cores will be stored onsite in plastic containers.

The three wells to be continuously logged and cored are spread out across the site from north to south and will give a good cross-sectional interpretation of the subsurface geology. In addition to the importance of subsurface geological characterization, it is important to determine where the water table is located during the installation of the monitoring wells, in order to properly place the screen interval. Rock coring requires water to be added to the boring, making it difficult to determine where the water table is located, which is why rock coring will not be conducted on all site wells. However, video logging will be conducted across the intervals to be screened for the wells that are not cored.

Because the purpose of the monitoring wells is to determine the nature and extent of contamination, they will be installed across the first saturated zone (non-perched) encountered during drilling. The existing monitoring wells at NASD were constructed with 2 ft of screen above the water table. To be consistent, this design will also be used for all new monitoring wells. Estimated monitoring well depths and screened intervals are shown in Table 4-3. The new monitoring wells will be constructed using 10 ft of 0.01-inch slot polyvinyl chloride (PVC) well screen coupled with 2-inch-diameter Schedule 40 PVC casing using flush joint threads.

#### 4.2.3.1 Groundwater Sampling and Analysis

The groundwater from the seven newly installed monitoring wells will be sampled for the full TAL/TCL list plus explosives. Both total and dissolved metals analyses will be conducted on the groundwater samples, as well as total dissolved solids (TDS). The groundwater from monitoring well MW-2 will additionally be sampled for total petroleum hydrocarbons (TPH)-gasoline range organics (GRO)/diesel range organics (DRO)/oil range organics (ORO) because of it's downgradient location from the former AST. In general total metals results will be used for risk assessment, unless the dissolved metals concentrations can be shown to be more representative of groundwater quality. TDS samples will be used to develop an understanding of the salinity of the groundwater, to assist in determining its potability.

A round of water-level measurements will be collected from all of the monitoring wells a minimum of 2 weeks after well development (in accordance with Region 2 policy), just prior to sampling. The groundwater from the monitoring wells will then be purged and sampled using

low-flow sampling techniques to minimize turbidity. Table 4-4 presents the number of groundwater samples to be collected as part of this evaluation, including the QA/QC sample collection protocol. Section 2 of the Master Field Sampling Plan for the Former NASD (CH2M HILL, 2001) presented details regarding the required containers, preservatives, sampling, and holding times for groundwater samples.

Parameters to be measured and logged in the field comprise temperature, pH, dissolved oxygen (DO), oxidation reduction potential (ORP), specific conductance, and turbidity.

#### 4.2.3.2 Hydraulic Conductivity Testing

In-situ hydraulic conductivity tests will be performed on all source area and downgradient monitoring wells at AOC R (MW-2 through MW-7) using the slug test method to obtain estimates of the aquifer hydraulic conductivity, groundwater flow velocity, and potential well yield at the site. Each test will involve installing a pressure transducer in the well connected to a data logger programmed to measure water level during the test. After the initial water level is measured, a 1-inch-diameter by 5-ft-long PVC slug will be lowered into the well. The rise and decline of the water level in the well will be observed until the approximate original water level elevation is achieved. The slug will then be quickly removed from the well, causing the water to drop rapidly. The data logger will measure and record the recovery of the water level in the well until the water level has reached the approximate pre-test groundwater elevation. The data will be analyzed using the methods described by Bouwer and Rice (1976) to develop a estimate of the hydraulic conductivity of the aquifer and its variability across the site.

### 4.2.4 Surface and Subsurface Soil Sampling and Analysis

Twenty nine surface soil samples and 15 subsurface soil samples will be collected during this RI, as shown in Figure 4-1. The samples will be analyzed for the parameters shown in Table 4-5. Only the surface soil samples will be analyzed for grain size. The samples will be collected as follows:

- Four surface and subsurface soil samples will be collected adjacent to the former AST south of Highway 200.
- Three surface soil samples will be collected at the locations of the munitions items located within the access restriction boundary shown in Figure 4-1 (six surface soil samples total), once the munitions items have been removed
- Eleven surface and subsurface soil samples and an additional eight surface soil samples will be collected the vicinity of the potential sources areas, near where samples were previously collected during the Expanded PA/SI.

This effort will result in a total of 44 new soil samples (29 surface and 15 subsurface), plus the additional QA/QC samples from AOC R.

Sampling techniques that may be employed for surface soil sampling include stainless-steel trowel, stainless-steel hand auger, and split-spoon sampling, depending on the nature of the material to be sampled and whether the surface soil sample is co-located with a subsurface soil sample. A stainless-steel hand auger will typically be used to collect surface soil samples that are not co-located with subsurface soil samples. All surface soil samples will be collected from 0 to 24 inches bls. Subsurface soil samples will be collected as follows:

- At each location, a subsurface soil sample will be collected in the 2-ft interval within the 2 to 6 ft zone, based on where visual and/or OVA screening suggests the presence of contamination. In the absence of visual or screening evidence of potential contamination, the subsurface soil sample will be collected from the 4 to 6-ft interval (or just above the water table or bedrock, if encountered before this depth).
- If bedrock is found deeper than 6 feet, and if soil contamination is suspected below 6 feet, based on visual and/or OVA screening, an additional subsurface soil sample will be collected from the interval where the highest level of contamination is suspected.

The procedures for soil collection and transfer of soil to sample jars are described in the SOP for shallow soil sampling in Attachment 2, Page 4.2-1 of the Master Work Plan for the Former NASD (CH2M HILL, 2001). Procedures for logging of soil borings are described in Attachment 2, page 4.5-1, of the Master Work Plan for the Former NASD (CH2M HILL, 2001).

Table 4-5 provides a listing of soil sample parameters and methods and includes the number of soil samples to be collected as part of this evaluation, including the QA/QC sample collection protocol. Samples will be analyzed for the full TCL/TAL list plus explosives. Additionally the four surface soil samples and four subsurface soil samples around the former AST will be analyzed for TPH GRO/DRO/ORO. Details regarding the required containers, preservatives, and holding times for soil samples were presented in Section 2 of the Master Field Sampling Plan for the Former NASD (CH2M HILL, 2001).

In the course of vegetation clearing and the field investigation, additional samples may be collected if other suspected contaminant sources are identified (e.g., additional debris) or if obvious migration pathways from potential contaminant sources to exposure media are observed.

### 4.2.5 Sampling Within the Ephemeral Stream

Three locations will be sampled in the ephemeral steam, as shown in Figure 4-1. One sample location is coincident with the munitions item identified in the stream bed, one sample location is upstream of this location, and one sample location is in a presumed downstream depositional area. All three locations were concurred upon by the CERCLA Technical Subcommittee during a site visit in June 2005. It was recognized at that time that the primary objective was to identify areas of standing water, if present, for sampling. Therefore, the upstream and downstream sample locations may be adjusted based on site conditions at the time of sampling.

All samples will be analyzed for the full TAL/TCL list plus explosives as shown in Tables 4-4 and 4-5. If during the sampling event, the streambed is submerged, the solid samples collected from the streambed will be designated "sediment" and will be collected from 0 to 6 inches. If, during the sampling event, the streambed is not submerged (i.e., unsaturated) the solid samples collected from the streambed will be designated "soil" and will be collected from 0 to 24 inches in accordance with the surface soil sampling protocol at AOC R. Sediment samples will also be analyzed for TOC, pH, and grain size using sieve analyses technique.

Surface water samples will also be analyzed for dissolved metals, hardness, and the field parameters pH, conductivity, salinity, dissolved oxygen, and temperature.

### 4.2.6 Sampling Equipment Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use. The applicable SOPs for the decontamination of personnel and equipment are presented in Attachment 2, Section 10.1.1, of the Master Work Plan, and are included with the FSP checklist. Tubing utilized in the low-flow sampling technique for groundwater will not be taken through the decontamination process because the tubing is pre-cleaned and then disposed of after a single use.

### 4.2.7 Surveying

All soil sample locations will be surveyed upon completion using a global position system (GPS). Monitoring wells will be surveyed for elevation by a licensed professional surveyor.

## 4.3 Sample Analysis and Validation

This task involves efforts related to sample management and data validation. CH2M HILL will be responsible for tracking sample analysis and obtaining results from the laboratory.

### 4.3.1 Sample Analysis

All analyses of soil and groundwater will be conducted at a contracted laboratory that fulfills requirements of the U.S. Navy's QA/QC Program Manual and USEPA's CLP and SW846 (for methods not covered by CLP). The contracted laboratory will have provided their method detection limit (MDLs) to CH2M HILL in their bid response so that a comparison will be made between screening criteria and the best available technology from the laboratory. A signed certificate of analysis will be provided with each laboratory data package, along with a certificate of compliance certifying that all work was performed in accordance with the CLP SOW. All analyses will be performed following the highest level of Navy guidance. Analyses will include the proper ratio of field QC samples recommended by Navy guidance for the DQOs.

This task includes checking the data from the laboratory and converting it to an electronic format that can be readily incorporated into the Geographic Information System (GIS) data management system for the Former NASD.

#### 4.3.1.1 Field Quality Control Procedures

Field QC samples comprise duplicates and blanks. Field duplicates measure the precision of the field sampling crew and provide an indication of the homogeneity of the sample matrix. The various blanks collected in the field are collected to ascertain possible sources of sample contamination. The QAPP and Tables 4-4 and 4-5 provide details with regard to the frequency of field QC sample collection.

##### 4.3.1.1.1 Blanks

Blanks provide a measure of cross-contamination sources, decontamination efficiency, and other potential errors that can be introduced from sources other than the sample.

American Society for Testing and Materials (ASTM) Type II water will be used for blanks. Four types of blanks can be generated during sampling activities: trip blanks, field blanks, equipment blanks, and temperature blanks.

Trip blanks are utilized to monitor VOC contamination. Every cooler that has VOC water and soil samples will have a VOC trip blank.

One field blank will be collected per lot of source water used for decontamination. If sampling events extend beyond 1 week (5 working days) or for windy and dusty field conditions, the number of field blanks may be increased. Field blanks are used to determine the chemical quality of water used for decontamination.

One equipment blank should be collected per day, per type of sampling equipment. Equipment blanks provide an indication of the efficiency of the decontamination procedure and indicate what possible contaminants may be artifacts from the decontamination process and not attributed to site activities.

A temperature blank will be included in each cooler containing samples so that the laboratory can record the temperature without disturbing the samples. The temperature blank will be labeled, but will not be given a sample number nor will it be listed as a sample on the chain-of-custody (COC) form. The temperature reading will be recorded on the COC form or on a sample receipt checklist.

#### 4.3.1.1.2 Duplicates

Field duplicate samples will be collected at a frequency of one field duplicate per 10 field samples, per matrix. The locations from which the duplicates are taken will be selected randomly. Each duplicate sample (other than for VOC analysis) will be homogenized and split evenly into two sample containers and submitted for analysis as two independent samples. This QC sample measures sampling precision and matrix homogeneity or heterogeneity.

#### 4.3.1.1.3 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD samples will be collected at a frequency of one MS/MSD set for every 20 field samples collected per matrix. The MS/MSD measurement provides measurements of accuracy and precision as they relate to a matrix. The percent recoveries of the MS and MSD (that is, the amount recovered of the amount spiked) provide the matrix accuracy statistic. The comparison of the MS/MSD recoveries (CLP) or concentrations (SW846) provide the measurement of matrix precision in percent relative standard deviation units.

### 4.3.2 Sample Designation

Sampling locations and samples collected during the investigation will be assigned unique designations to allow the sampling information and analytical data to be entered into the existing GIS Data Management system. The existing designation scheme for the Former NASD will be used by field personnel. The following sections describe the sample designation specifications.

#### 4.3.2.1 Specifications for Field Location Data

Field station data consist of information assigned to a physical location in the field at which some type of sample is collected. For example, a soil boring that has been installed will require a name that will uniquely identify it with respect to other soil boring locations, or other types of sampling locations. The station name provides for a key in the database to which any samples collected from that location can be linked, to form a relational database.

A listing of the location identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all field activities. Each station will be designated by an alphanumeric code that will identify the station location by facility, site type, site number, station type, and sequential station number. Table 4-6 documents the scheme that will be used to identify field station data.

#### 4.3.2.2 Specifications for Analytical Data

Analytical data will be generated through sampling of various media. Each analytical sample collected will be assigned a unique sample identifier. The scheme used as a guide for labeling analytical samples in the field is included in the following subsection. The format that will be used for electronic deliverables from the analytical laboratory and the data validator is also included in the following subsection.

#### 4.3.2.3 Sample Identification Scheme

A standardized numbering system will be used to identify all samples collected during water and soil sampling activities. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. A listing of the sample identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all sampling activities. The format described below will be used for identification of all samples collected during the investigations.

Each sample will be designated by an alphanumeric code that will identify the facility, site, matrix sampled, and will contain a sequential sample number. The QA/QC samples will have a unique sample designation. Table 4-6 documents the general guide for sample identification. If one qualifier is pertinent to the sample ID but another is not, only the Table 4-7 applicable qualifiers will be used. A non-utilized character space does not have to be maintained.

### 4.3.3 Data Validation

Analytical results will be validated by CH2M HILL subcontractors approved by the Navy. Data validators will use USEPA's Region 2 worksheets utilizing the USEPA guidance document *Contract Laboratory Program National Functional Guidelines for Organic (1999) and Inorganic Data Review (2002)*. Areas of review include (when applicable to the method) holding time compliance, calibration verification, blank results, matrix spike precision and accuracy, method accuracy as demonstrated by laboratory confirmation samples (LCSs), field duplicate results, surrogate recoveries, internal standard performance, and interference checks. A Region 2 data review worksheet will be completed for each method of each data package and any non-conformance will be documented. This data review and validation process is independent of the laboratory's checks and focuses on the usability of the data to support the project data interpretation and decision-making processes.

Data that are not within the acceptance limits will be appended with a qualifying flag, which consists of a single- or double-letter abbreviation that reflects a problem with the data. Primary and secondary (descriptive) flags are presented and defined in Appendix E.

### 4.3.4 Electronic Deliverable File Format

An offsite laboratory will analyze the samples collected for the RI and will tabulate the results in an electronic format specified by CH2M HILL. The data validator will add data validation

qualifiers to the hard copy Form Is. CH2M HILL will receive an electronic file from the laboratory that will facilitate downloading into a database. CH2M HILL will enter the validation flags into the database and perform QA to ensure viability and completeness of the database along with a concurrence check between the hard copy Form Is and the electronic data deliverables (EDDs). Appendix D presents the EDD format required by CH2M HILL.

## 4.4 Data Quality Evaluation

The EDD will be checked against the hard copy results to ensure agreement and comparability. The database will then be populated with the data validation subcontractor's primary and secondary qualifiers. Post-validation queries will then be applied to the populated database to ensure that the populated data are logical and have no apparent anomalies. Once this is accomplished, the data quality evaluation (DQE) queries are generated and reviewed by the project chemist for discrepancies that logic alone may not discover. At this point, the database is deemed complete and ready to generate project reports and the final DQE queries for the data quality evaluation technical report.

The purpose of the DQE process is to assess the effect of the overall analytical process on the usability of the data. The two major categories of data evaluation are laboratory performance and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements; either the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of matrix interferences is more subtle and involves the analysis of several areas of results, including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

The DQE deliverable is a DQE Technical Memorandum (TM) that can be used by the project team to readily understand project-specific data usability. Topics to be addressed in the DQE TM include the following:

- *Potential blank contamination* – the effect on the usability of data for targets detected in samples which may have been detected in field or laboratory blanks.
- *Laboratory accuracy and precision* – evaluation of the recovery(ies) for blank spike/blanks spike duplicate (or LCS/LCSD) samples for method precision and accuracy.
- *Tuning and calibration* - evaluation of all calibration requirements and criteria to evaluate percent completeness and usability per analytical fraction and analyte.
- *Potential matrix interferences* – evaluation of the matrix accuracy and precision for surrogates, internal standards, MS/MSDs, and field duplicate sample results. Serial dilutions, method of standard additions, and degradation checks are also evaluated.
- *Assessment of PARCC* – comparison of data validation (DV) findings with PARCC (precision, accuracy, representativeness, comparability, and completeness).

The DQE includes a detailed discussion of these areas and detailed tables that present data for the decision-making process.

**TABLE 4-1**
Previously Conducted Sampling at AOC R as Reported in Expanded PA/SI Report
*Former NASD, Vieques, Puerto Rico*

| Event/Activity | Samples | Purpose | Findings |
|---|---|---|---|
| **Expanded PA/SI (2002) included the following investigations:** | | | |
| Ecological Survey | Plant and animal survey | Characterize ecology, identify threatened and endangered species, qualitative impact analysis | No protected species identified, No impacts from AOC R reported |
| Soil Sampling | 34 Surface Soil Samples | Determine if RI/FS is required or NFA | Several metals and SVOCs detected in surface soil above human health and/or ecological screening criteria |
| Field Screening for VOCs | Field screening with an OVM was conducted on 34 soil samples collected at 50-ft intervals | Determine if subsurface soil had more mobile VOCs | No VOCs were detected in any of the 34 readings |

## MEC INFORMATION FORM

**DATE/TIME:** _____ **IDENTIFICATION# (ID):** _____
**LOCATION:** _____

1. **ITEM REMOVED FROM SITE (YES/NO)**

2. **WHO REMOVED THE ITEM?**
   **Name:**_____ **Organization:** _____

3. **IF ITEM WAS REMOVED, WHERE WAS IT TAKEN?** _____
   _____

4. **ITEM DESTROYED ONSITE (YES/NO)**

5. **WHO DESTROYED ITEM?**
   **Name:** _____ **Organization:** _____
   **Time of Detonation:**_____ **MEC Down Time:**_____

6. **MEC ITEM ENCOUNTERED:**

| Type | Reference Information Location* | Condition | Disposition |
|---|---|---|---|
| | | | |

***Identify location where records regarding information on this item are located (e.g., field book # and date, electronic file name and location, paper form ID and location) or record parameters listed below in comments section.**

- The site vegetation, topography and soil/bedrock type
- Transect locations (for Inland MRS)
- Geographic location
- MEC size
- Qualitative magnitude of geophysical sensor response for subsurface anomaly
- Orientation of item
- The condition of the MEC (whether or not expended)
- Disposal method if item is removed
- Disposal date if applicable
- Whether or not he MEC is fuzed and contains explosive filler

7. **US NAVY NOTIFIED AT (TIME):** _____ **REP:** _____

8. **CH2MHILL PERSONNEL NOTIFIED AT (TIME):** _____ **REP:** _____

9. **COMMENTS (Significant events or findings):** _____
   _____
   _____
   _____

_____ _____
**CH2MHILL UXO Representative (Signature)** **CH2MHILL UXO Representative (Print Name)**

| CHECKED BY _____ | APPROVED BY _____ |
|---|---|

**TABLE 4-3**
AOC R Monitoring Well Construction Summary
*Former NASD, Vieques, Puerto Rico*

| | Former AST | Former Staging Area | Vehicle Maintenance |
|---|---|---|---|
| Number of Monitoring Wells | 2 | 2 | 3 |
| Monitoring Well Depth (ft) | 50 | 30 | 30 |
| Screened Interval (ft) | 10 | 10 | 10 |

**TABLE 4-4**
Groundwater and Surface Water Sample Parameters, Methods, and Quantities for AOC R
*Former NASD, Vieques, Puerto Rico*

| Parameter | Method | No. of Samples |
|---|---|---|
| VOCs | LL-OLCO3.2 | 10 |
| SVOCs | LL-OLCO3.2 | 10 |
| Metals | ILM05.3 | 10 |
| Dissolved Metals | ILM05.3 | 10 |
| Thallium | ILM05.3 | 10 |
| Thallium dissolved | ILM05.3 | 10 |
| TPH | 8015M | 1 |
| TDS | 160.1 | 10 |
| Pesticides/PCBs | LL-OLCO3.2 | 10 |
| Explosives | SW846 8330 | 10 |

Notes:
Trip blank – one for cooler containing VOCs
Equipment blanks – one per day
Field Blanks – one per lot of equipment rinsate blank (ERB) source water
Field Duplicates – one per every 10 samples per matrix/medium or per batch, whichever is most frequent
Matrix Spike/Matrix Spike Duplicates – One per 20 samples per matrix or batch, whichever is most frequent

**TABLE 4-5**
Soil and Sediment Sample Parameters, Methods, and Quantities for AOC R
*Former NASD, Vieques, Puerto Rico*

| Parameter | Method | No. of Samples |
|---|---|---|
| Metals/ cyanide | ILM05.3 | 47 |
| Thallium | ILM05.3 | 47 |
| SVOCs | OLM04.3 | 47 |
| Explosives | SW846 8330 | 47 |
| Pesticides | OLMO4.3 | 47 |
| PCBs | OLMO4.3 | 47 |
| VOCs | OLMO4.3 | 47 |
| TPH GRO | 8015M | 8 |
| TPH DRO/ORO | 8015M | 8 |
| TOC | 9060A/Lloyd Kahn | 47 |
| Soil pH | 9045C | 47 |
| Grain Size | ASTM (D422) | 32 |

Notes:
Trip blank – one for cooler containing VOCs
Equipment blanks – one per day
Field Blanks – one per lot of ERB source water
Field Duplicates – one per every 10 samples per matrix/medium or per batch, whichever is most frequent
Matrix Spike/Matrix Spike Duplicates – One per 20 samples per matrix or batch, whichever is most frequent
Laboratory method will be required to achieve reporting limit equal to or less than the adjusted residential PRG (default method will be SW846 Method 7841, unless lab can demonstrate ability to achieve required reporting limit using alternative method)

**TABLE 4-6**
Field Station Scheme
*Former NASD, Vieques, Puerto Rico*

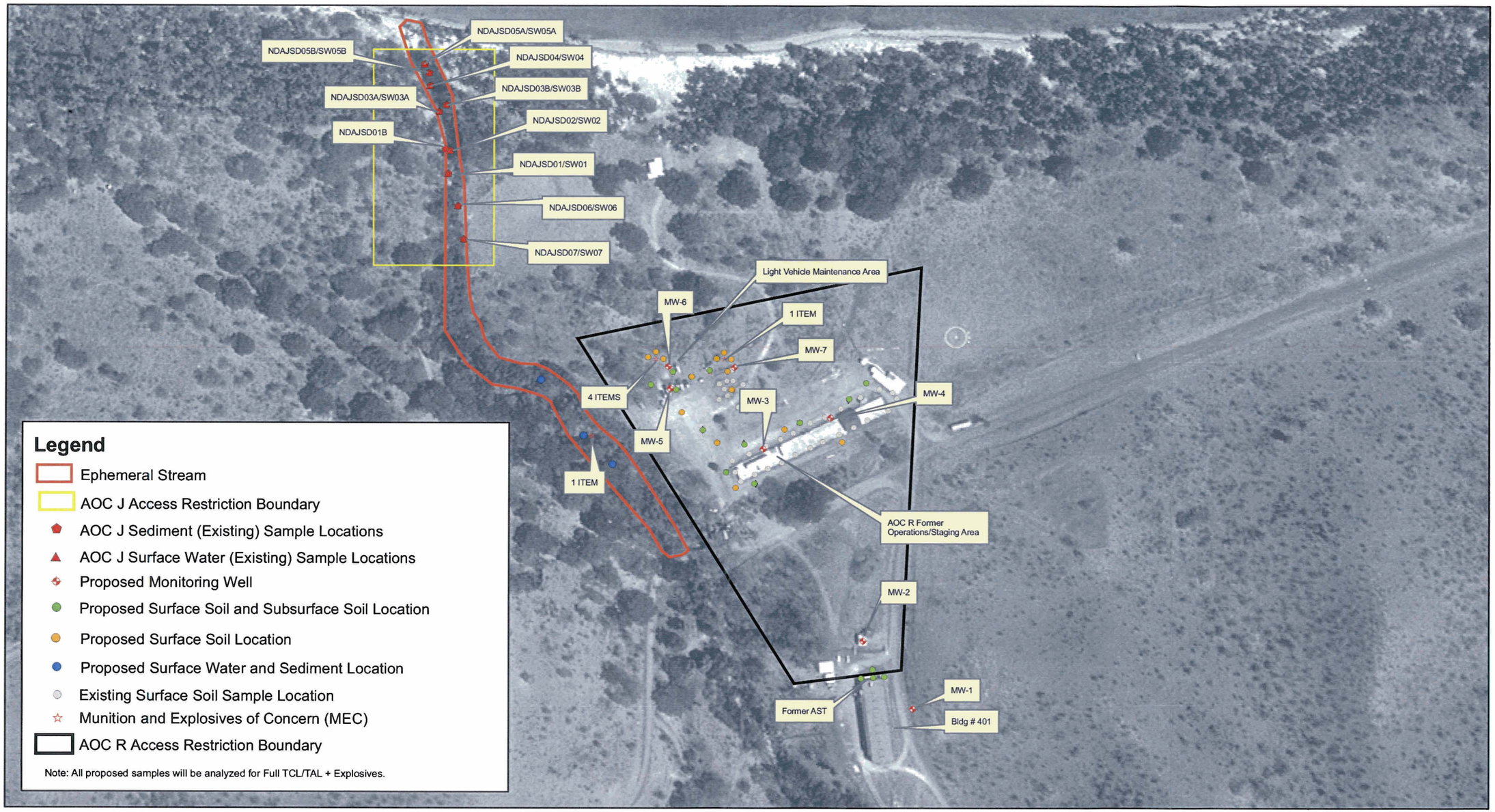
| First Segment | Second Segment | |
|---|---|---|
| **Facility, Station Type, Site Number** | **Station Type** | **Station Number, Qualifier** |
| **AAAA** | **AA** | **NN-A** |
| *Facility*:<br>ND = NASD<br><br>*Station Type*:<br>A = AOC<br><br>*Site Number:*<br>R – AOC R | *Sample Type:*<br>SB = Subsurface Soil<br>SS = Surface Soil<br>MW = Monitoring Well<br>GW = Groundwater Sample Location | *Station Number:*<br>Sequential Station Number (01, 02, 03…)<br><br>*Qualifier:*<br>S = Shallow<br>R = Replaced Well<br>D = Deep<br>K = Background<br>R = Resampled soil |

"A" = alphabetic
"N" = numeric

**TABLE 4-7**
Sample Designation Scheme
*Former NASD, Vieques, Puerto Rico*

| First Segment | Second Segment | | Third Segment |
|---|---|---|---|
| **Facility, Station, and Site Number** | **Sample Type** | **Sample Location + Sample Qualifier** | **Additional Qualifiers (sample depth, sampling round, etc.)** |
| **AAAA** | **AA** | **NNNA or NNAA** | **ANN or NNNN** |
| Facility:<br>ND = NASD<br><br>Station Type:<br>A = AOC<br><br>Site Number:<br>R – AOC R | Sample Type:<br>DS = Direct Push - Soil<br>SS = Surface Soil<br>TB = Trip Blank<br>EB = Equipment Blank<br>FB = Field Blank<br>FD = Field Duplicate<br>SB = Soil Boring | Sample Location:<br>1. Station Samples (NNA)<br>**NN**A - refers to sequential station number<br>NN**A** - letter qualifier for Deep, Shallow, or Composite, sample (if applicable).<br>2. QC Samples (NNN)<br>**N**NN – numbered sequentially for each type of blank (i.e., 1, 2, etc.) collected for that day's sampling<br>N**NN** - refers to month of sampling event<br>Sample Qualifiers:<br>F = filtered sample<br>P = duplicate sample<br>K = background sample | Additional Qualifiers:<br>1. Monitoring Well Groundwater Sample (refers to sampling round for that well):<br>R01 – Round 1<br>R02 – Round 2<br>R03 – Round 3<br>2. Direct Push Subsurface Sample (refers to depth of sample):<br>Enter depth of top of sample interval<br>3. QC Samples<br>NNNN – refers to day and year of sampling event |

"A" = alphabetic
"N" = numeric




Source : 1967 Aerial Photograph

N
W E
S

300 150 0 300 Feet

**Figure 4-1**
**AOC R Surface Soil, Subsurface Soil, Surface Water, Sediment, and Groundwater Sample Locations.**
*Former NASD, Vieques, Puerto Rico.*

\\topaz\gis\Proj\Vieques\AOC R 11x17 FIG 4-1FIXC.mxd Date 9/23/05
Peter Cooney

SECTION 5

# Remedial Investigation Report

A Draft RI Report will be prepared following completion of the RI. An outline of the RI Report from the RI/FS guidance (USEPA, 1988) is presented below, which will be used as a general guidance. However, the actual report outline may be different from that shown below.

**Remedial Investigation Report**

Executive Summary

1. Introduction
   - 1.1 Purpose of Report
   - 1.2 Site Background
     - 1.2.1 Site Description
     - 1.2.2 Site History
     - 1.2.3 Previous Investigations
     - 1.2.4 Physical Characteristics of Study Area
   - 1.3 Report Organization

2. Field Activities
   - 2.1 Decontamination of Sampling Equipment
   - 2.2 Monitoring Well Installation
   - 2.3 Monitoring Well Development
   - 2.4 Monitoring Well Purging and Sampling
   - 2.5 Groundwater Elevation Measurements
   - 2.6 Surface Soil Sampling
   - 2.7 Subsurface Soil Sampling
   - 2.8 Surface Water and Sediment Sampling
   - 2.9 Aquifer Performance Testing
   - 2.10 Surveying
   - 2.11 Laboratory Field Sampling Protocol

3. Nature and Extent of Contamination
   - 3.1 Risk-Based Criteria Screening Procedure
   - 3.2 Soils
   - 3.3 Groundwater
   - 3.4 Surface Water and Sediment

4. Contaminant Fate and Transport
   - 4.1 Potential Routes of Migration
   - 4.2 Contaminant Persistence
   - 4.3 Contaminant Migration

SECTION 6

# Project Schedule

Table 6-1 presents the proposed project schedule for the supplemental sampling activities at AOC R. It is important to note that the dates are estimates, and may vary substantially depending on such factors as reviewer comments, subcontractor availability, and weather.

**TABLE 6-1**
Project Task Schedule, RI for AOC R
*Former NASD, Vieques, Puerto Rico*

| Task | Estimated Submittal Date |
|---|---|
| Final Work Plan | November, 2005 |
| Field Work | November 14, 2005 to start AOC R field work |
| Laboratory Analysis | Approximately 4 weeks from completion of field work |
| Data Validation | Approximately 4 weeks from receipt of all analytical data from laboratory |
| Human Health Risk Assessment Interim Deliverables | Approximately 4 weeks from upload of validated data to environmental database |
| Draft RI Report | Approximately 8 weeks from USEPA approval of Interim Deliverables |

SECTION 7

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# Executive Summary

This work plan presents proposed Remedial Investigation (RI) activities at Area of Concern (AOC) R site identified within the Former Naval Ammunition Support Detachment (NASD) located on the western portion of Vieques Island, Puerto Rico. The site was previously investigated as part of the Expanded Preliminary Assessment/Site Investigation (PA/SI), Phase II, Seven Sites Report (CH2M HILL, 2002) and the Environmental Baseline Survey (EBS) (Program Management Company [ERM], 2000). Analytical results from these investigations indicated a need for further investigation at AOC R. Therefore, additional data collection is proposed as part of this RI effort to further characterize the site and define the nature and extent of contamination in the site media.

AOC R was used as a construction staging area and public works operational area from approximately 1965 to 1971. The site is located along Highway 200 approximately 1.5 miles east of Laguna Kiani and 580 ft south of the coastline. The large concrete pad at the site was present before the Navy owned the area and can be seen in 1937 aerial photographs. In the late 1960s, a carpentry shop and an enlisted club were located on the pad. Light vehicle maintenance activities, such as oil changes, were conducted near the pad to the northwest. An above-ground storage tank (AST) was once located near Building 401, and its contents are unknown. In addition, several debris areas containing munitions items have been identified at the site.

A conceptual site model for AOC R identifies the areas described above as potential contaminant source areas. Spills, leaks, or other releases from these areas, if they occurred, could have contaminated soil. Soil contamination, if present, could migrate to the ephemeral stream located near the western boundary of the site and/or leach to the underlying groundwater.

In order to adequately assess the nature and extent of contamination at AOC R, approximately 29 surface soil samples and 15 subsurface soil samples will be collected for analyses. Additionally, seven groundwater monitoring wells will also be installed across the site. Samples in the ephemeral stream will also be collected to determine if runoff from debris and/or munitions areas have adversely affected the stream. All samples collected during the RI will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), inorganics, explosives, pesticides, and polychlorinated biphenyls (PCBs) to develop an adequate understanding of the nature and extent of contamination at the site, if present.

The results of this sampling effort, as well as the previous data from the Expanded PA/SI, will be utilized, as appropriate, to evaluate potential risks to human health and the environment. If the risk assessment results indicate that constituent concentrations at the site do not pose an unacceptable risk to human health and the environment, no further evaluation or remedial action will be recommended in the RI report. Otherwise, further investigation will be recommend if additional data are needed, or a feasibility study (FS) will be recommended if unacceptable levels of potential risk are identified that require remediation.

**APPENDIX A**

# CH2M HILL Site Health and Safety Plan

# CH2M HILL Site Safety and Health Plan

This Site Safety and Health Plan will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL Health and Safety Program, Program and Training Manual, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1-1. The main object of this project is to conduct a Remedial Investigation/Feasibility Study (RI/FS) on sites AOC I and AOC R.

## 1.1 Project Information

PROJECT NO: 180357.PP.WP

CLIENT: United States Navy

PROJECT/SITE NAME: Remedial Investigation/Feasibility Study (RI/FS) on site AOC R

SITE ADDRESS: Vieques Island, Puerto Rico

CH2M HILL PROJECT MANAGER: Brett G. Doerr

CH2M HILL OFFICE: Virginia Beach, Virginia

DATE HEALTH AND SAFETY PLAN PREPARED: March 29, 2004

DATE(S) OF SITE WORK: October 2005 – April 2006

SITE ACCESS: All investigation sites are located at the Former NASD, in the western portion of Vieques Island, Puerto Rico.

SITE SIZE: 8,000 acres

### 1.1.1 Site Topography

The regional topography of Vieques consists generally of hills and valleys throughout the entire island. The western side of the island consists of gently rolling hills with a deeper soil profile than the eastern, more exposed rugged terrain. The highest point on the western side of the island is found at Mount Pirata with an elevation of 1,000 ft, while the highest point on the eastern side is found at Cerro Matías with an elevation of 420 ft. In addition to the terrain mentioned above, the coastal areas demonstrate their own topography. These areas contain level terrain primarily made up of lagoons and mangrove swamps.

### 1.1.2 Prevailing Weather

The climate of Vieques is characterized as warm and humid (tropical-marine), with frequent showers occurring throughout the year. The temperature on Vieques is affected by the easterly

trade winds blowing across the island year-round. This wind moderates the temperature throughout the year, causing an annual mean temperature of 79ºF to 80ºF, and a mean daily temperature range of 15ºF to 25ºF. The average annual rainfall on the island is approximately 36 inches, with extremes being 25 inches in the east and 45 to 50 inches in the west.

### 1.1.3 Site Description and History

Vieques is the largest offshore island of Puerto Rico, with a surface area of approximately 51 square miles. It is located approximately 7 miles east-southeast of the eastern end of the main island of Puerto Rico, where NSRR is located. The Former NASD occupies the western end of the island of Vieques, encompassing approximately 7,878 acres. The majority of the site is undeveloped and heavily vegetated with trees, low lying brush, and tall grasses. The southwestern portion of the site is the least developed, with the exception of the communications facilities on top of Mount Pirata (within the Former NASD but not technically a part of the site). The central eastern portion of the site was utilized for munitions magazines, which are scattered throughout the area. The northeastern portion of the site is the most developed, containing facilities for the main support compound. The southeastern portion of the site contains the ROTHR station and associated facilities.

The Former NASD was utilized by the U.S. Navy Atlantic Fleet for storage of munitions. The activities at the Former NASD were directed under the consolidated command of Commander Fleet Air Caribbean, Naval Forces Caribbean, and Antilles Defense Command, whose headquarters were at NSRR. The mission of the Former NASD was to receive, store, and issue all ordnance authorized by NSRR for support of Atlantic Fleet activities. Munitions were stored in numerous bunkers located throughout the Former NASD. Other than the bunkers, the only other significant developments at the Former NASD consisted of the main support compound located in the northeast portion of the facility, the Mount Pirata telecommunication sites located in the southwest portion of the facility, and the ROTHR site located in the southeastern portion of the facility.

Munitions are not currently stored at the Former NASD and no Navy activities are being conducted at the facility, other than operations at the Mount Pirata telecommunication sites and the ROTHR facility.

The U.S. Navy ceased facility-wide operations on the former NASD on April 30, 2001, in accordance with the January 30, 2000, Presidential Directive to the Secretary of Defense relating to the transfer of lands of the Navy-owned western portion of Vieques. The land transfer was completed on May 1, 2001, and the Navy has had no presence at the main operational area since that date.

The main operational area of the former NASD remained largely undisturbed from May 2001 until early 2003, when the MOV began using a few of the buildings for public works vehicle storage and maintenance activities.

The site to be investigated is listed below:

- AOC R – Former Staging Area

Figure 1-1 presents the location of the RI/FS site at the Former NASD. As part of the Navy's IRP, these three sites are being investigated in accordance with the CERCLA process to assess the potential presence of hazardous constituents at the sites.

AOC R was used as a construction staging area and public works operational area from approximately 1965 to 1971. The large concrete pad north of Highway 200 at AOC R was present before the Navy owned the area, and can be seen in 1937 aerial photographs. In the late 1960s, a carpentry shop and an enlisted club were located on the pad. Light vehicle maintenance activities, such as oil changes, were conducted near the pad to the northwest. Additionally, a large AST was once located near Building 401, south of Highway 200.

## 1.2 Tasks to be Performed Under this Plan

### 1.2.1 Description of Tasks

Refer to project documents (i.e., Work Plan) for detailed task information. A risk analysis (Section 1.3) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin.


British Virgin Islands

Anegada

U.S. Virgin Islands

Virgin Gorda

Tortola

St. Thomas

St. John

San Juan

Culebra

U.S. Naval Activity Puerto Rico

PUERTO RICO

VIEQUES

WEST VIEQUES
(Former NASD)

EAST VIEQUES
(Former Vieques Naval Training Range & Former Eastern Maneuver Area)

St. Croix

N

Scale in Miles

0 15

**Figure 1-1**
**Regional Location Map**
*Vieques, Puerto Rico*

#### 1.2.1.1 Hazwoper-Regulated Tasks

- Site Layout
- Vegetation removal
- Soil Sampling
- Monitoring Well Construction and Sampling
- Hand auguring
- Surveying
- Investigation-derived waste (drum) sampling and disposal

#### 1.2.1.2 Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites**.

## 1.3 Activity Hazard Analysis for RI/FS

Table 1-1 shows hazards analysis, and Table 1-2 shows inspection requirements.

| Potential Hazards | Tasks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Test pit/ excavation | Drilling, geoprobe, and well installation & abandonment | Groundwater monitoring, aquifer testing | Surface water and sediment sampling using a boat | Surface water and sediment sampling from the shore or water | Hand augering | Surveying | IDW drum sampling and disposal | Observation of loading material for offsite disposal | Remediation & construction oversight |
| Flying debris/objects | X | X | | X | X | X | | X | X | X |
| Noise > 85dBA | X | X | | X | | | | | X | X |
| Electrical | X | X | X | X | | | | | | X |
| Suspended loads | X | X | | X | | | | | X | X |
| Buried utilities, drums, tanks | X | X | | | | X | | | | X |
| Slip, trip, fall | X | X | X | X | X | X | X | X | X | X |
| Back injury | X | X | X | X | X | X | | X | | X |
| Confined space entry | X | | | | | | X | | | X |
| Trenches / excavations | X | | | | | | | | | X |
| Visible lightning | X | X | X | X | X | X | X | X | X | X |
| Vehicle traffic | | | | | | | | | X | X |
| Elevated work areas/falls | X | | | | X | | | | | X |
| Fires | X | X | | | X | | | X | | X |
| Entanglement | | X | | | | X | | | | |
| Drilling | | X | | | | | | | | |
| Heavy equipment | X | X | | X | | | | | X | X |
| Working near water | | | | | X | | | | | |
| Working from boat | | | | X | | | | | | |
| IDW Drum Sampling | | | | | | | | X | | |

# 1.4 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC or UXOSO for clarification.

## 1.4.1 Project-Specific Physical (Safety) Hazards

The main physical or safety hazards posed to CH2M HILL personnel during project activities are:

- Thermal (heat) stress
- Noise
- Explosion and fire
- Utilities
- Heavy equipment
- Fall hazards
- Ordnance
- Power tools
- Manual vegetation removal equipment

The health and safety control measures for these hazards are outlined in the following section of this plan.

## 1.4.2 General Hazards and Housekeeping

- Site work will be performed only during daylight hours.
- Hearing protection must be worn in areas where you need to shout to hear someone within 3 ft.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Stairs or ladders are generally required when there is a break in elevation of 19 inches or more.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.

- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

### 1.4.3 Hazard Communication

The SSC is to perform the following:

- Complete an inventory of chemicals brought onsite by CH2M HILL using Attachment 1-3.
- Confirm that an inventory of chemicals brought onsite by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from LANTDIV, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive onsite, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 1-3.

### 1.4.4 Shipping and Transportation of Chemical Products

Chemicals are not expected to be needed as part of the field efforts. If chemicals are determined to be necessary, these chemicals might be defined as hazardous materials by DOT. All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

### 1.4.5 Manual Lifting

Proper lifting techniques must be used when lifting any object.

- Plan storage and staging to minimize lifting or carrying distances.
- Split heavy loads into smaller loads.
- Use mechanical lifting aids whenever possible.
- Have someone assist with the lift, especially for heavy or awkward loads.
- Make sure the path of travel is clear prior to the lift.

### 1.4.6 Slips, Trips and Falls

- Institute and maintain good housekeeping practices.
- Pick up tools and debris in the work area.
- Walk or climb only on equipment surfaces designed for personnel access.

- Be aware of poor footing and potential slipping and tripping hazards in the work area.

### 1.4.7 Fire Prevention

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 ft. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 ft. Extinguishers must:
  - Be maintained in a fully charged and operable condition
  - Be visually inspected each month
  - Undergo a maintenance check each year
- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 ft from any building.
- Solvent waste and oily rags must be kept in a fire-resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

### 1.4.8 Electrical

- All temporary wiring, including extension cords, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
  - Equipped with third-wire grounding
  - Covered, elevated, or protected from damage when passing through work areas
  - Protected from pinching if routed through doorways
- Electrical power tools and equipment must be effectively grounded or double-insulated UL-approved.
- Electrical power tools, equipment, and cords are to be inspected for damage before use. If damaged, they should be tagged and removed from service.
- Operate and maintain electrically powered equipment according to manufacturer's instructions.
- Protect all electrical equipment, tools, switches, and outlets from elements.
- Only qualified personnel are to work on energized electrical circuits and equipment. Only authorized personnel are permitted to enter high-voltage areas.
- Properly label switches, fuzes, and breakers.

- All 120-volt, single-phase 15 and 20 ampere receptacle outlets on construction sites, which are not part of the permanent building wiring, must be equipped with GFCIs for personnel protection.
- All portable electric generator receptacles must be effectively grounded by bonding the receptacle grounding wire to the generator frame.

### 1.4.9 Ladders

- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Portable ladders must extend at least 3 ft above landing surface.
- User must face the ladder when climbing; keep belt buckle between side rails.
- User must use both hands to climb; use rope to raise and lower equipment and materials.
- Straight and extension ladders must be tied off to prevent displacement.
- Ladders that may be displaced by work activities or traffic must be secured or barricaded.
- Fixed ladders >20 ft in height must be provided with fall-protection devices.
- Stepladders are to be used in the fully opened and locked position.
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top of or straddle a stepladder.
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.

### 1.4.10 Heat and Cold Stress

#### 1.4.10.1 Preventing and Treating Heat Stress

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Take regular breaks in a cool, shaded area. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation The devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.

- Provide adequate shelter or shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Monitor buddy for signs of heat stress. Persons who experience signs of heat rash or heat cramps should consult the UXOSO or SSC to avoid progression of heat-related illness.
- Those who experience heat syncope (sudden fainting), heat exhaustion (hot, pale, clammy/moist skin), or heat stroke (red, hot, dry skin; loss of consciousness) must be cooled down immediately and provided cool water or sports drink. Persons who experience heat syncope or heat exhaustion should also seek medical attention as soon as possible. Persons who experience heat stroke must get immediate medical attention.

#### 1.4.10.2Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress.

The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

#### 1.4.10.3Preventing and Treating Cold Stress

- Be aware of the symptoms of cold-related disorders, and wear proper clothing for the anticipated fieldwork.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC) (CH2M HILL SOP HS-09).
- Wind-chill index is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it is used only as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- NSC Guidelines for work and warm-up schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience signs of incipient frost bite (frost nip) or incipient hypothermia (generally cold, shivering) should consult the UXOSO to avoid progression of cold-related illness.

- Persons who experience signs of frost bite (discolored, waxy, resilient skin) or hypothermia (low body temperature characterized by uncontrollable shivering, weakness, apathy, etc.) must be warmed and provided warm fluids (not hot, and no caffeinated drinks), and must get immediate medical attention.

### 1.4.11 Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations, and must be positioned to avoid being struck or knocked over; contacting electrical circuits; or being exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

### 1.4.12 Procedures for Locating Buried Utilities

**Local Utility Mark-Out Service**

Name: Ondeo (formerly PRASA) – water utilities

Phone: (787) 741-2001

Name: Caleb Romero, NSSR, Puerto Rico
Phone: (787) 865-4429, Ext. 4068/4268

- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable of locations of utilities. Check locations against information from utility mark-out service.
- Where necessary (e.g., uncertainty about utility locations), excavation or drilling of the upper depth interval should be performed manually.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon).
- When LANTDIV or another onsite party is responsible for determining the presence and locations of buried utilities, the UXOSO should confirm that arrangement.

### 1.4.13 Working Near Water

When working near water, and there is a risk of drowning:

- U.S. Coast Guard-approved personal flotation devices (PFDs), or life jackets, provided for each employee will be worn.
- PFDs will be inspected before and after each use. Defective equipment will not be used.
- Sampling and other equipment will be used according to the manufacturer's instructions.
- A minimum of one life-saving skiff will be provided for emergency rescue.
- A minimum of one ring buoy with 90 ft of 3/8-inch solid-braid polypropylene (or equal) rope will be provided for emergency rescue.

### 1.4.14 Working on Water

- Safe means of boarding or leaving a boat or a platform will be provided to prevent slipping and falling.
- The boat/barge must be equipped with adequate railing.
- Employees should be instructed on safe use.
- Work requiring the use of a boat will not take place at night or during inclement weather.
- The boat/barge must be operated according to U.S. Coast Guard regulations (speed, lightning, right-of-way, etc.).
- The engine should be shut off before refueling; do not smoke while refueling.

### 1.4.15 IDW Drum Sampling

Personnel are permitted to handle or sample drums containing IDW only; handling or sampling other drums requires a plan revision or amendment approved by the CH2M HILL HSM. The following control measures will be taken when sampling drums containing IDW:

- Minimize transportation of drums.
- Sample only labeled drums or drums known to contain IDW.
- Use caution when sampling bulging or swollen drums. Relieve pressure slowly.
- If drums contain (or potentially contain) flammable materials, use non-sparking tools to open.
- Picks, chisels, and firearms may not be used to open drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer the content of drums using a method that minimizes contact with material.
- PPE and air monitoring requirements specified in Sections 1.6 and 1.7 must address IDW drum sampling.

- Spill-containment procedures specified in Section 1.9 must be appropriate for the material to be handled.

## 1.4.16 Confined Space Entry

No confined space entry will be permitted. Confined space entry requires additional health and safety procedures, training, and a permit. If conditions change such that confined-space entry is necessary, contact the HSM to develop the required entry permit.

When planned activities will not include confined-space entry, permit-required confined spaces accessible to CH2M HILL personnel are to be identified before the task begins. The SSC is to confirm that permit spaces are properly posted or that employees are informed of their locations and hazards.

## 1.4.17 Working Around Material Handling Equipment

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Because heavy equipment may not be equipped with properly functioning reverse signal alarms, never turn your back on any operating equipment.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers, and is equipped with a firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.

## 1.4.18 Biological Hazards and Controls

### 1.4.18.1 Snakes

No poisonous snakes are indigenous to Puerto Rico.

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. DO NOT apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

### 1.4.18.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

### 1.4.18.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in length. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray only outside of clothing with permethrin or permanone and spray skin only with DEET. Check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots might appear under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

### 1.4.18.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

### 1.4.18.5 Bloodborne Pathogens

Exposure to bloodborne pathogens may occur when rendering first aid or cardio-pulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and PPE are required as specified in CH2M HILL SOP HS-36, Bloodborne Pathogens. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

### 1.4.18.6 Other Anticipated Biological Hazards

The following paragraphs identify the potential hazards associated with flora and fauna at the site. If additional concerns are identified, they will be added to this SSHP.

Hazardous Flora. Incidence of contact by individuals to poisonous and thorny plants is high, especially during sampling activities; therefore, bare skin should be covered (i.e., long pants and shirt, steel-toed boots, leather or cotton gloves, safety glasses, and head protection) as much as practical when working in forested or densely vegetated areas. Personnel should avoid entering an area in the direct path of known poisonous flora; a secondary route should be

selected. Care should also be taken when walking in such areas because uneven terrain or vines may present a tripping hazard.

While attempting to cut into dense underbrush, hazards exist from the sharp machete and gas-powered weed cutter. Therefore, care should be taken when using such devices. (Note: Hearing protection, steel-toed boots, gloves, and safety glasses are required when using weed cutters.) All rashes and other injuries will be reported to the SSC as soon as they are known.

Hazardous Fauna. Mosquitoes and sand flies pose a nuisance and physical hazard to field personnel; they distract workers, leading to accidents, and pose a physical threat by transmitting live microorganisms. Sand fly bites that are repeatedly scratched can cause secondary infections. Avoid the use of perfumes and scented deodorants, and don light colored clothing. The use of Avon's "Skin So Soft" or other insect repellent is encouraged.

The potential exists to come in contact with other dangerous insects; these include centipedes, fire ants, bees, wasps, hornets, mites, fleas, and spiders. All personnel should perform "checks" on each other periodically and at the end of the work shift, especially when working in grassy or forested areas. All insect bites must be reported to the SSC.

No poisonous snakes are indigenous to Puerto Rico, only non-poisonous snakes such as the Boa Constrictor. Feral (wild) dogs and cats have been observed.

Mongeese, rats, and mice have been documented to (potentially) carry rabies. There is some evidence that mongeese can be infected with the rabies virus in an attenuated form, allowing them to carry and spread the virus for a considerable time before succumbing to the disease. Any observed unusual behavior by mongeese and other mammals must be reported. Signs of rabies can be characterized in two forms. Animals with furious rabies exhibit agitation and viciousness, followed by paralysis and death. Animals with dumb rabies exhibit lethargy and paralytic symptoms, followed by death. Behavioral indicators for both include fearlessness and change in nocturnal/diurnal rhythms.

Working in wet or swampy areas unprotected shall not be allowed because of the presence of a variety of etiologic (disease-causing) agents. Contact with surface water will be kept to a minimum. There have been several incidents of infection by schistosomes (blood flukes) from contact with surface water. The aquatic snail vector, *Australorbis glabratus*, transmits the schistosomes into surface waters, predominantly drainage ditches. Even momentary contact (especially in the presence of blisters, cuts, and open sores) with contaminated surface water is sufficient to acquire an infection. Accidental skin contact requires that the area be washed with isopropyl alcohol (as directed by SSC). Symptoms of infection are fever, diarrhea, itchy skin, and central nervous system (CNS) damage. Schistosomiasis is hard to treat; once established in its host, it may remain for several years.

Before beginning site activities, each individual shall be questioned as to any known sensitivities to the previously mentioned organisms or agents.

Dengue Fever and Other Illnesses. According to the Centers for Disease Control (CDC), Dengue Fever is primarily a viral infection transmitted by mosquito bites in residential areas. The mosquitoes are most active during the day, especially around dawn and dusk, and are frequently found in and around human habitations. The illness is flu-like and characterized by sudden onset, high fever, severe headaches, joint and muscle pain, and rash. The rash appears 3

to 4 days after the onset of fever. Because there is no vaccine or specific treatment, prevention is important. To reduce mosquito bites, travelers should wear clothes that cover most of the body. Travelers should also take insect repellent with them to use on any exposed areas of skin. The most effective repellent is DEET (N,N-diethyl meta-toluamide). Avoid applying high-concentration DEET (greater than 35 percent) products to the skin and refrain from applying repellent to portions of the hands that are likely to come in contact with the eyes and mouth. Rarely, toxic reactions or other problems have developed after contact with DEET. Please note that personnel performing water sampling should refrain from using DEET because the breakdown products can show up as false positive results in lab analysis. For greater protection, clothing can be soaked in or sprayed with permethrin, which is an insect repellent licensed for use on clothing. If applied according to directions, permethrin will repel insects from clothing for several weeks.

**Traveler's Diarrhea** is the most frequent health problem for travelers. It can be caused by viruses, bacteria, or parasites that are found universally throughout the region. Transmission is most often through contaminated food or water. Purchase food and beverages from vendors that are professional. Avoid small roadside stands and drink bottled beverages when possible. The use of over-the-counter or prescriptions medications can reduce the length of the attack. Although the potable water supply (from the tap) in Vieques is generally of excellent quality, field personnel should take precautions if they have a known sensitivity to chlorine.

**Hepatitis A** is a viral infection of the liver transmitted by the fecal oral route; through direct person to person contact; from contaminated water, ice, or shellfish; or from fruits or uncooked vegetables contaminated through handling. Symptoms include fatigue, fever, loss of appetite, nausea, dark urine, jaundice, vomiting, aches and pains, and light stools. No specific therapy supportive care is available, only supportive care. The virus is inactivated by boiling or cooking to 85$^{o}$C for 1 minute. Therefore, eating thoroughly cooked foods and drinking only treated water serve as general precautions. CDC recommends hepatitis A vaccine as a precaution.

Fire Ant Bites. Fire ants typically build mounds on the land surface that are usually easy to identify. Avoid disturbing these mounds. A bite from a fire ant can be painful but rarely is life threatening. It is possible, however, that the bite could cause an allergic reaction. If bitten, check for symptoms of an allergic reaction such as weakness, nausea, vomiting, dizziness, or shortness of breath. If symptoms appear, seek medical attention.

### 1.4.19 Radiological Hazards and Controls

Radiological hazards are not expected at this site. If new or additional information is provided that indicates that radiological hazards may be present, stop work and refer to CH2M HILL's Health and Safety Program, Program and Training Manual, and Health and Safety Program Radiation Protection Manual for SOPs in contaminated areas.

### 1.4.20 Contaminants of Concern

Contaminants of potential concern (COPCs) at AOC I and AOC R, include the following general categories of waste:

- Asphalt/Fuels
- Waste Oils
- SVOCs

Table 1-3 shows potential exposure routes.

TABLE 1-3
Potential Routes of Exposure

| | | |
|---|---|---|
| **Dermal**: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 1.6. | **Inhalation**: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 1.6 and 1.7, respectively. | **Other**: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking). |

### 1.4.20.2 Fuels/Asphalt

Contact with lighter fuels causes rapid drying of the skin, leading to chapping, cracked skin, and dermatitis. Vapors are irritating to eyes, nose, and throat. Inhalation leads to dizziness, nausea, and headaches. Ingestion is poisonous, causing damage to CNS, kidneys, and liver.

### 1.4.20.4Waste Oils

Waste oils will cause skin irritation from prolonged contact and are generally toxic if ingested. The physical hazard associated with oil is combustibility.

The data presented in a chemical/material data sheet reflect the chemical and toxicological properties of the specific compound in a pure, non-diluted state. As such, when these compounds are detected in environmental media (i.e., soil, groundwater, sediment, and surface water), the hazards are anticipated to be substantially less than those associated with exposure to pure compounds. The data presented in these data sheets, therefore, will be utilized as reference information when questions arise as to a constituent's chemical and toxicological properties or measures for emergency response.

Note: Likely contaminants are described below for SWMU 6, SWMU 7, AOC-H and AOC-J. However, this Site Safety and Health Plan is intended for use at all sites at the Former NASD.

AOC-I – Asphalt Plant. Analytical results indicated detections of aluminum, arsenic, iron, manganese, and vanadium above the USEPA Region IX residential Preliminary Remedial Goals (PRGs). Total chromium was detected above the leachability criteria (SSLD20). Total chromium, iron, and vanadium were identified above the NASD background values. TPH was also detected above the PREQB criterion of 100 mg/kg, indicating that a petroleum release had occurred. However, no petroleum-derived hazardous constituents (VOCs, SVOCs, BTEX) were detected at levels above their respective USEPA Region IX Residential Risk-based Concentrations (RBCs) in soil samples collected at AOC I. TPH, asphalt, and chrome are the main contaminants of concern.

**AOC-R – Former Staging Area.** Aluminum, arsenic, chromium, iron, manganese, and vanadium were detected in surface soil samples at concentrations exceeding the industrial or residential PRGs and/or leachability screening criteria (SSDL20). Arsenic, chromium, iron, lead, and vanadium were also identified at concentrations above the background metals values established for the Former NASD.

Several SVOC concentrations exceeded industrial and residential PRGs. These constituents are typically associated with asphalt, and may have originated from previously paved areas at the former public works area.

# 1.5 Project Organization and Personnel

## 1.5.1 CH2M HILL Employee Medical Surveillance and Training

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated SSC have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed in Table 1-4 are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

TABLE 1-4
CH2M HILL Employees Currently in Medical Surveillance Program

| Employee Name | Office | Responsibility | SSC/FA-CPR |
|---|---|---|---|
| Kenji Butler | TPA | Field Team Leader | Level D; FA-CPR |
| Rick Gorsira | TPA | Field Team Member | Level D SSC; FA-CPR |
| Mark Stinnett | GNV | Field Team Member | Level D SSC; FA-CPR |
| John Swenfurth | TPA | Field Team Member | Level D, SSC, FA-CPR |

## Field Team Chain of Command and Communication Procedures

**Client**

Contact Name: Jeff Harlow, RPM
Phone: (757) 322-4787
Facility Contact Name: Not Available (N/A)
Phone: N/A

**CH2M HILL**

Project Manager: Brett Doerr/VBO
Health and Safety Manager: Michael Goldman/ATL
Field Team Leader and SSC: Kenji Butler/TPA

**CH2M HILL Subcontractors**

Drilling Subcontractor – to be selected

Brush Removal Subcontractor – to be selected

Surveying Subcontractor – to be selected.

The subcontractors listed above are covered by this SSHP and must be provided a copy of this plan. This plan does not, however, address hazards associated with the tasks and equipment in which the subcontractor has expertise (e.g., UXO avoidance). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and should include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both CH2M HILL's and the subcontractor's SSHPs.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Sheet included in Attachment 6-1.
- Ask subcontractor(s) to brief the project team on the hazards and precautions related to their work.

- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action; the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeated non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in the project field logbook, daily reports, or other records.

**Contractors**

This plan does not address contractors who are contracted directly to LANTDIV. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and must never assume such responsibility through our actions (e.g., advising on safety and health issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so staff remain aware of appropriate precautions that apply to CH2M HILL. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 6-5 are to be used by the SSC to review the contractor's performance ***only*** as it pertains to evaluating our exposure and safety.

Safety and health-related communications with contractors should be conducted as follows:

- Ask the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
  - Notify the contractor safety representative.
  - Request that the contractor determine and implement corrective actions.
  - If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify LANTDIV, Project Manager, and HSM as appropriate.
- If apparent contractor non-compliance/unsafe conditions or practices are observed, inform the contractor safety representative. Our obligation is limited strictly to informing the contractor of our observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. Our obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions.

- Document all oral health and safety related communications in the project field logbook, daily reports, or other records.

## 1.6 Personal Protective Equipment (PPE)

Table 1-6 details the protective equipment necessary for various site tasks.

TABLE 1-6
Personal Protective Equipment

| PPE SPECIFICATIONS [a] | | | | |
|---|---|---|---|---|
| **Task** | **Level** | **Body** | **Head** | **Respirator [b]** |
| General site entry<br>Surveying<br><br>Oversight of drilling | D | Work clothes; steel-toed, leather work boots [g]; work glove. | Hardhat [c]<br>Safety glasses<br>Ear protection [d] | None required |
| Tasks requiring upgrade or downgrade for reasons presented below | C | Coveralls: Polycoated Tyvek®<br>Boots: Steel-toed, chemical-resistant boots [g] OR steel-toed, leather work boots [g] with outer rubber boot covers<br>Gloves: Inner surgical-style nitrile and outer chemical-resistant nitrile gloves. | Hardhat c<br>Splash shield [c]<br>Ear protection [d]<br>Spectacle inserts | APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent. |
| Vegetation Removal | Modified D | Chaps | Face Shield | None required |

| Reasons for Upgrading or Downgrading Level of Protection | |
|---|---|
| **Upgrade** | **Downgrade** |
| • Request from individual performing tasks<br>• Change in work tasks that will increase contact or potential contact with hazardous materials<br>• Occurrence or likely occurrence of gas or vapor emission<br>• Known or suspected presence of dermal hazards<br>• Instrument action levels (Section 1.7) exceeded | • New information indicating that situation is less hazardous than originally thought<br>• Change in site conditions that decreases the hazard<br>• Change in work task that will reduce contact with hazardous materials |

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the UXOSO. UXO technicians are required to wear hard hats except when investigating suspect UXO.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 ft or less without shouting.
[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is >85 percent, or if organic vapor measurements are > midpoint of Level C range (refer to Section 1.7)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.
[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an UXOSO or SSC qualified at that level is present.
[g] Steel-toed boots are not required during surface geophysics mapping.

# 1.7 Air Monitoring/Sampling

## 1.7.1 Air Monitoring Specifications

Table 1-7 shows relevant air monitoring specifications.

TABLE 1-7
Air Monitoring Specifications

| Instrument | Tasks | Action Levels[a] | | Frequency [b] | Calibration |
|---|---|---|---|---|---|
| **CGI:** MSA model 260 or 261 or equivalent | Drilling (well installation and soil boring) | 0-10% :<br>10-25% LEL:<br>>25% LEL: | No explosion hazard<br>Potential explosion hazard<br>Explosion hazard; evacuate or vent | Continuous during advancement of boring or trench | Daily |
| **$O_2$Meter:** MSA model 260 or 261 or equivalent | Drilling (Well Installation and Soil Boring) | >25%[c] $O_2$:<br>20.9%[c] $O_2$:<br><19.5%[c] $O_2$: | Explosion hazard; evacuate or vent<br>Normal $O_2$<br>$O_2$ deficient; vent or use SCBA | Continuous during advancement of boring or trench | Daily |
| **Detector Tube:** Drager benzene specific 0.5/c (0.5 to 10 ppm range) with pre-tube, or equivalent | When positive PID indications >1 ppm | <0.5 ppm<br>0.5-1 ppm<br>>1 ppm | Level D<br>Level C<br>Stop Work | Initially and periodically when PID/FIB >1 ppm | Not applicable |
| PID: Organic Vapor Monitor (OVM) with 10.6eV lamp or equivalent | All intrusive operations. | 0 – 1 parts per million (ppm)<br>>1 – 5 ppm<br>> 5 ppm | Level D<br>Level C<br>Stop Work | Initially and periodically during task | Daily |

[a] Action levels apply to sustained breathing-zone measurements (2 minute duration) above background.
[b] The exact frequency of monitoring depends on field conditions and is to be determined by the UXOSO SSC; generally, every 5 to 15 minutes is acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., “Breathing Zone/MW-3”, “at surface/SB-2”, etc.).

### 1.7.2 Calibration Specifications

Table 1-8 shows calibration specifications.

| Instrument | Gas | Span | Reading | Method |
|---|---|---|---|---|
| **PID:** OVM, 10.6 or 11.8 eV bulb | 100 ppm isobutylene | RF = 1.0 | 100 ppm | 1.5 lpm reg T-tubing |
| **PID:** MiniRAE, 10.6 eV bulb | 100 ppm isobutylene | CF = 100 | 100 ppm | 1.5 lpm reg T-tubing/0.5 lpm reg, direct tubing with Tedlar BAG |
| **CGI:** MSA 260, 261, 360, or 361 | 0.75% pentane | N/A | 50% LEL $\pm$ 5% LEL | 1.5 lpm reg direct tubing |

### 1.7.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other Occupational Safety and Health Administration (OSHA) regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain VOCs. Contact the HSM immediately if these contaminants are encountered.

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel.

## 1.8 Decontamination

The SSC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SSC. The SSC must ensure that procedures are established for disposing of materials generated on the site.

### 1.8.1 Decontamination Specifications

Table 1-9 shows the general decontamination specifications.

TABLE 1-9
Decontamination Specifications

| Personnel | Sample Equipment | Heavy Equipment |
|---|---|---|
| • Boot wash/rinse<br>• Glove wash/rinse<br>• Outer-glove removal<br>• Body-suit removal<br>• Inner-glove removal<br>• Respirator removal<br>• Hand wash/rinse<br>• Face wash/rinse<br>• Shower immediately<br>• Dispose of PPE in municipal trash, or contain for disposal<br>• Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal | • Wash/rinse equipment<br>• Solvent-rinse equipment<br>• Contain solvent waste for offsite disposal | • Power wash<br>• Steam clean<br>• Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal |

### 1.8.2 Diagram of Personnel Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-2 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SSC to accommodate task-specific requirements.

## 1.9 Spill Prevention and Containment Procedures

This section establishes minimum site requirements. Subcontractors are responsible for spill prevention and control related to their operations. Subcontractors written spill prevention and control procedures must be consistent with this plan. All spills must be reported to the supervisor, site manager, and Project Manager.

### 1.9.1 Spill Prevention

All fuel and chemical storage areas will be properly protected from onsite and offsite vehicle traffic. Fuel storage tanks must be equipped with secondary containment. Fuel tanks must be inspected daily for signs of leaks. Accumulated water must be inspected for signs of product before discharge.

Incidental chemical products must be properly stored, transferred, and used in a safe manner. If chemical product use occurs outside areas equipped with spill control materials, adequate spill control materials must be maintained.

### 1.9.2 Spill Containment and Control

Spill control materials will be maintained in the support zone and at fuel storage and dispensing locations. Incidental spills will be contained with sorbent and disposed of properly. Spilled materials must be immediately contained and controlled. Spill response procedures include taking the following actions:

- Immediately warn any nearby personnel and notify the work supervisor.
- Assess the spill area to ensure that it is safe to approach.
- Activate site evacuation signal if the spill presents an emergency.
- Ensure that any nearby ignition sources are immediately eliminated.
- If it can be done safely, stop the source of the spill.
- Establish site control for the spill area.
- Use proper PPE in responding to the spill.
- Contain and control spilled material through the use of sorbent booms, pads, or other materials.

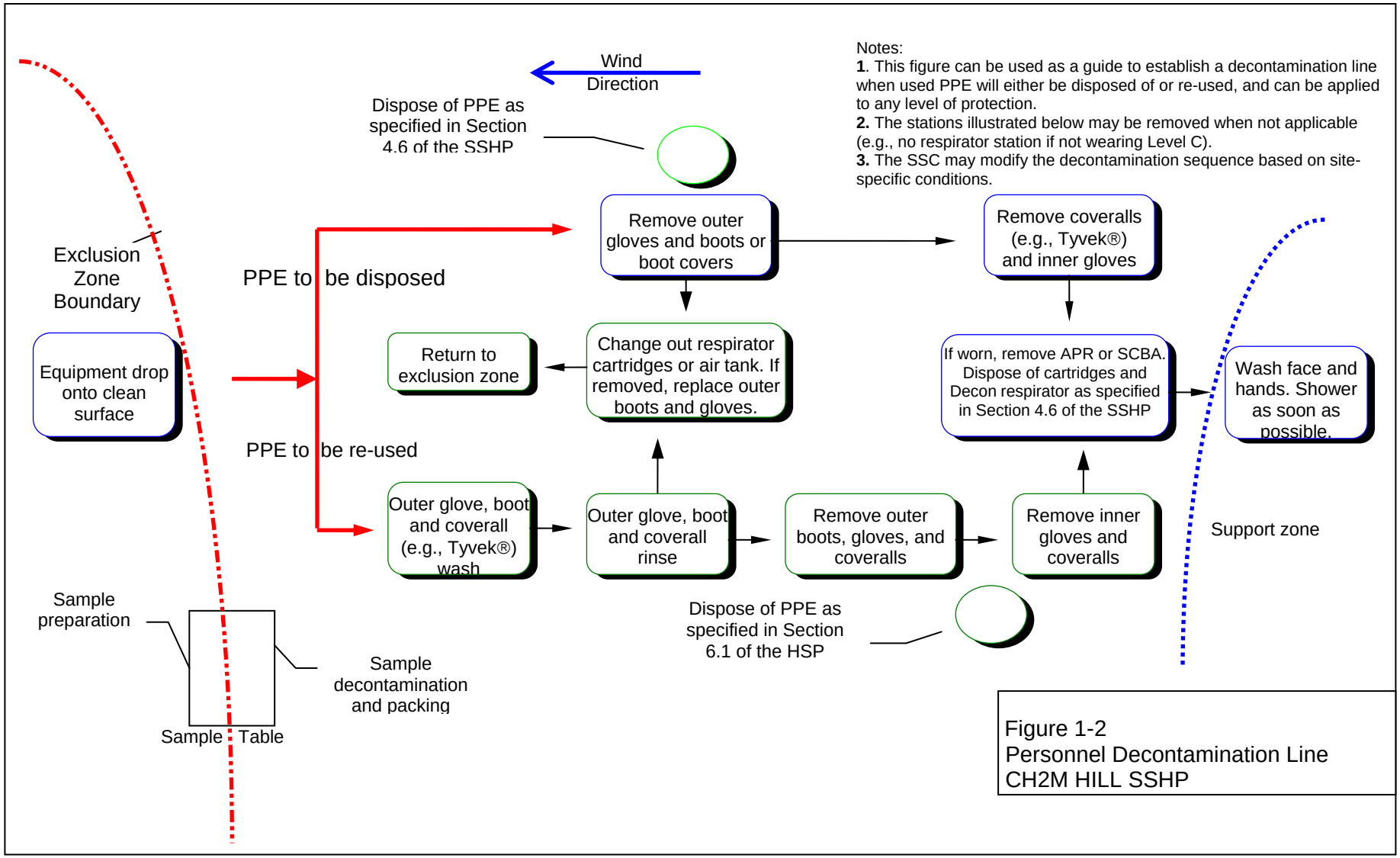


Figure 1-2
Personnel Decontamination Line
CH2M HILL SSHP

### 1.9.3 Spill Clean-up and Removal

All spilled material, contaminated sorbent, and contaminated media will be cleaned up and removed as soon as possible. Contaminated spill material will be drummed, labeled, and properly stored until material is disposed of. Contaminated material will be disposed of according to applicable federal, state, and local requirements. Contact the regulatory compliance person for the project or the program for assistance.

## 1.10 Site Control Plan

### 1.10.1 Site Control Procedures

- The SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing onsite safety include general discussion of the SSHP, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, and emergencies.
- The SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-71, OSHA Postings.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the "buddy system."
- Initial air monitoring is conducted by the SSC in appropriate level of protection.
- The SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan: refer to Sections 1.2 and 1.3. Deficiencies are to be noted, reported to the HSM, and corrected.

### 1.10.2 Hazwoper Compliance Plan

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.2.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in

Section 1.2.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed onsite, or while non-Hazwoper-trained staff are working near Hazwoper activities. Other data (e.g., soil) also must document that no potential exists for exposure. The HSM must approve the interpretation of these data. Refer to subsections 1.4.20 and 1.7 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-Hazwoper-trained personnel of the following:
  - Nature of the existing contamination and its locations
  - Limitations of their access
  - Emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that a potential for exposure to health and safety hazards no longer exists.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is (for the purposes of applying the Hazwoper standard) considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hours of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

# 1.11 Emergency Response Plan

## 1.11.1 Pre-Emergency Planning

The SSC will perform the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency service providers as appropriate. These tasks include:

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Each team will have a communication device (cell phone or two-way radio)
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).

- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to LANTDIV, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The S SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

## 1.11.2 Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map, as illustrated in Table 1-10.

TABLE 1-10
Sample Supply List and Locations

| Emergency Equipment and Supplies | Location |
|---|---|
| 20 pound (lb) (or two 10-lb) fire extinguisher (A, B, and C classes) | Support Zone/Heavy Equipment |
| First aid kit | Support Zone/Field Vehicle |
| Eye Wash | Support & Decon Zone/Field Vehicle |
| Potable water | Support & Decon Zone/Field Vehicle |
| Bloodborne pathogen kit | Support Zone/Field Vehicle |
| Additional equipment (specify) | N/A |

## 1.11.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.

- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

### 1.11.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 1.11.8 (e.g., 911).
- The SCC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 1.11.7.

### 1.11.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the SUXOS or SSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SSC and a "buddy" will remain onsite after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.

- The SSC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SSC will write up the incident as soon as possible after it occurs and submit a report to the Director of Health and Safety.

## 6.11.6 Evacuation Signals

Table 1-11 provides some samples of possible evacuation signals.

TABLE 1-11
Evacuation Signals

| Signal | Meaning |
|---|---|
| Grasping throat with hand | Emergency-help me. |
| Thumbs up | OK; understood. |
| Grasping buddy's wrist | Leave area now. |
| Continuous sounding of horn | Emergency; leave site now. |

## 1.11.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the Project Manager and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to LANTDIV as required in contract.

## 1.11.8 Emergency Contacts (complete during project start-up)

| **24-hour CH2M HILL Emergency Beeper – 888/444-1226** | |
|---|---|
| **Medical Emergency – 911**<br>Facility Medical Response #: N/A<br>Local Ambulance #: (787) 741-2151 | CH2M HILL Medical Consultant<br>Dr. Peter Greaney<br>GMG WorkCare, Orange, CA<br>(800) 455-6155<br>(After hours calls will be returned within 20 minutes) |
| **Fire/Spill Emergency – 911**<br>Facility Fire Response #:N/A<br>Local Fire Dept #: (787) 741-2111 | Local Occupational Physician<br>N/A |
| **Security & Police – 911**<br>Facility Security #:<br>Local Police #: (787) 741-2020 | Corporate Director Health and Safety<br>Name: Mollie Netherland/SEA<br>Phone: (206) 453-5005<br>24-hour emergency beeper: (888) 444-1226 |
| **Utilities Emergency**<br>Water: (787) 741-2001<br>Gas: N/A<br>Electric: | Health and Safety Manager (HSM)<br>Name: Michael Goldman<br>Phone: (770) 604-9182 (office) ext 592; (770) 335-2076<br>(Cell) Pager: (888) 856-9114 |
| **Site Safety Coordinator (SSC)**<br>Name: Rick Gorsira<br>Phone: (813) 874-6522 Ext. 4313 | Regional Human Resources Department<br>Name: Mary Jo Jordan<br>Phone: (352) 335-5877 |
| **Project Manager**<br>Name: Brett G. Doerr<br>Phone: (757) 518-9666 Ext. 414 | Corporate Human Resources Department<br>Name: John Monark/COR<br>Phone: (303) 771-0900 |
| **Federal Express Dangerous Goods Shipping**<br>Phone: 800/238-5355<br>CH2M HILL Emergency Number for Shipping Dangerous Goods<br>Phone: (800) 255-3924 | Worker's Compensation and Auto Claims<br>Sterling Administration Services<br>Phone: (800) 420-8926 After hours: (800) 497-4566<br>Report fatalities and report vehicular accidents involving pedestrians, motorcycles, or more than two cars. |
| Federal Agency/Contact Name: DOI/Oscar Díaz Marrero Phone(787) 741-2138<br>State Agency/Contact Name: PREQB/Yarissa Martínez Phone(787) 767-8181x2953<br>Local Agency/Contact Name: MOV Public Works/Pablo Connelly Pagán Phone(787) 741-4442<br>Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies. | |
| Facility Alarms: N/A | Evacuation Assembly Area(s): Outside of building 2016 |
| Facility/Site Evacuation Route(s): Take Route 200 east | |
| Hospital Name/Address: Vieques Municipal Hospital | Hospital Phone #: (787) 741-2151 |
| **Directions to Hospital** | |
| For minor first aid and stabilization of personnel, proceed to local Vieques hospital. The hospital is located on route 997. Take Route 200 east (towards Isabel Segunda) for approximately 6 miles. Make a right on Route 997 going south (towards Camp García). The hospital will be ½ mile down the road on the left hand side. For extreme or life threatening emergencies, Vieques hospital also has a helicopter on duty. | |

# 1.12 Approval

This SSHP has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project

or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified, and must be amended if those conditions change.

### 1.12.1 Original Plan

Written By: Brett G. Doerr Date: 02/11/05

Approved By: Michael Goldman Date: _____

### 1.12.2 Revisions

Revisions Made By: _____ Date: _____

Revisions to Plan: _____

Revisions Approved By: _____ Date: _____

## 1.13 Attachments

Attachment 1-1: Employee Signoff Form – Site Safety and Health Plan

Attachment 1-2: Project-Specific Chemical Product Hazard Communication Form

Attachment 1-3: Chemical-Specific Training Form

Attachment 1-4: Applicable Material Safety Data Sheets

Attachment 1-5: Lead Awareness Training

## ATTACHMENT 1-1

CH2MHILL

*EMPLOYEE SIGNOFF FORM*

Site Safety and Health Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this FSI, have read and understood it, and agree to abide by its provisions.

Project Name: RI/FS Project Number:

| EMPLOYEE NAME (Please print) | EMPLOYEE SIGNATURE | COMPANY | DATE |
|---|---|---|---|
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## ATTACHMENT 1-2

**CH2MHILL**

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: NASD Vieques Project Number:

MSDSs will be maintained at the following location(s): No chemicals are expected to be used as part of the OE surveys and removals. If chemicals are brought to the site for use during the investigation, the chemicals will be added to this form and the appropriate MSDS Sheets will be attached to this plan.

*Hazardous Chemical Products Inventory*

| Chemical | ***Quantity*** | Location | MSDS Available | ***Container labels*** | |
|---|---|---|---|---|---|
| | | | | Identity | Hazard |
| | | | | | |
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Refer to SOP HS-05 Hazard Communication for more detailed information.

## ATTACHMENT 1-3

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

| | |
|---|---|
| Location: | Project # : |
| HCC: | Trainer: |

TRAINING PARTICIPANTS:

| NAME | SIGNATURE | NAME | SIGNATURE |
|---|---|---|---|
| | | | |
| | | | |
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REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

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|---|---|
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| | |

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

# ATTACHMENT 1-4: APPLICABLE MATERIAL SAFETY DATA SHEETS

To be inserted at project start up.

# ATTACHMENT 1-5: LEAD AWARENESS

## Lead Exposure Training Instructions

This module was designed for employees who work in areas with percent levels of inorganic lead or areas where there is a potential lead exposure above the action level of 30 $\mu g/m^3$.

### Lead Exposure Training Program

The OSHA lead standard (29 CFR 1910.1025) requires employers to provide lead training for those employees who may be exposed to inorganic lead above the action level of 30 $\mu g/m^3$. This training program satisfies this OSHA requirement and is provided to assist employees in recognizing lead exposure hazards and understanding the procedures to be followed to minimize exposure.

### Objectives

- Inform employees of the possible adverse health effects of lead exposure
- Inform employees of the regulatory requirements when working with or around lead
- Identify how lead exposures could occur on CH2M HILL projects

### How to complete this training

Employees are required to read the training materials that follow and complete a short quiz. The training materials must be read thoroughly and understood before completing the quiz; you will have only one chance at answering each question.

Quiz scores will automatically be sent to the Health and Safety Training Administrator. A minimum score of 70 percent must be obtained to receive credit for this training. If a passing score is obtained, the H&S Training Administrator will issue you a certificate of completion. If a passing score is not obtained, you are required to contact your regional health and safety program manager to discuss the training material directly.

# Lead Exposure Training

## 1. Uses And Occurrences

Lead is a well-known naturally-occurring metal found in the earth's crust, often associated with silver and zinc. It has had a variety of uses since antiquity, but its greatest use today is in car batteries. It was formerly used in gasoline, water pipes, pottery glazes, paint, solder, and as metal alloy. It currently has a variety of other uses such as radiation shielding, as vibration dampening material, in explosives, bullets, magnets, and in electronic equipment. It is also a common contaminant at hazardous waste sites.

## 2. Physical Characteristics

Lead exist as the familiar soft, dull gray metal, as a white or red solid as lead oxide, a gray or black solid as lead sulfide (galena), a white solid as lead sulfate, all which are insoluble in water. There are numerous other forms of inorganic lead. The organic forms, tetraethyl lead and tetramethyl lead, used in the past in fuels, are flammable colorless liquids also insoluble in water.

## 3. Toxicity and Hazards

Lead is a highly toxic substance that has a variety of adverse health effects from both chronic and acute exposure. An acute exposure to high levels of lead can cause a brain condition known as encephalopathy which can lead to death in a few days. The more common chronic exposure can also cause brain damage, blood disorders (anemia), kidney damage, damage to the reproductive system of both men and women and toxic effects to fetuses. Lead is stored in the bones and eliminated from the body very slowly. Consequently, exposures to low levels over many years can cause these adverse health effects. Lead is toxic by inhalation and ingestion, but is not absorbed through the skin. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in mouth, anxiety, insomnia and muscle and joint pain or soreness.

## 4. Regulations

Inorganic lead has been specifically regulated in general industry by OSHA since 1981 (29 CFR 1910.1025) and in construction (29 CFR 1926.62) since 1994. The 8-hour permissible exposure limit is 50 $\mu g/m^3$. There is no short-term exposure limit. OSHA also specifies an action level of 30$\mu g/m^3$. These limits apply to both general industry and construction. Initial air monitoring must be done whenever there are indications of lead exposure above the action level. If the action level is not exceeded, air monitoring can cease. If the action level is exceeded, initial blood lead level monitoring must be made available. If exposed above the action level for more than 30 days in a year, medical surveillance must be provided which includes further blood lead level monitoring and a medical examination. If specified blood levels are exceeded, the employee must be removed from the job or task where lead exposure occurs. Training must also be provided. If the PEL is exceeded, engineering controls must be implemented to reduce exposure. If engineering controls are not feasible or ineffective, respirators must be provided and worn. Air-purifying respirators with high-efficiency (HEPA) filters can be worn when airborne levels are as high as 500 $\mu g/m^3$. If levels exceed this amount, supplied air respirators must be worn. In addition, if the PEL is

exceeded, OSHA requires the establishment of regulated areas, showers, change rooms, separate clean lunchrooms and warning signs. Regulated areas are demarcated from the rest of the workplace to limit access to authorized personnel who have received lead training. To enter a regulated area you must also wear protective clothing. Tetraethyl and tetramethyl lead each have separate PELs of 100 $\mu g/m^3$ and 150 $\mu g/m^3$ respectively, and are not covered under the inorganic lead regulation.

## 5. How Exposures Can Occur At CH2M HILL Projects

Exposure to lead can occur at hazardous waste sites where lead is found in soil or groundwater and at old mining sites or former smelter sites. Exposure to lead-containing dust could occur during drilling, heavy equipment movement or other soil-disturbing activities. Dust formation can be minimized by wetting soils. Exposure could also occur during lead paint removal activities, during welding on metal surfaces with lead-containing paint, or in project work in smelters, battery recycling or manufacturing plants or at some mines.

## 6. Additional Information

Persons working at hazardous waste sites with known high amounts in soils (3 percent or 30,000 ppm) should have blood lead draws taken before and after site work. Air sampling should be done during soil disturbing activities at the site. Person working at non-hazardous waste site who have information or suspect they have been exposed to lead above the action level should contact a health and safety manager to determine if medical monitoring is needed or other regulatory requirements apply.

# Lead Quiz

1. Which of the following is not a mode of entry of lead?
    A. Inhalation
    B. Ingestion
    C. Skin absorption
    D. All of the above are modes of entry
2. Which of the following is not a common symptom of lead exposure?
    A. Loss of appetite
    B. Metallic taste in mouth
    C. Muscle and joint pain or soreness
    D. All are common symptoms of lead exposure
3. What are the OSHA exposure limits for lead (PEL and action level)?
    A. 50 $\mu g/m^3$ and 25 $\mu g /m^3$ respectively
    B. 50 ppm and 25 ppm respectively
    C. 50 ppm and 30 ppm respectively
    D. 50 $\mu g/m^3$ and 30 $\mu g /m^3$ respectively
4. When is air monitoring required for lead exposures?
    A. When exposed to lead for 30 days or more in a year
    B. Anytime lead is present in the workplace
    C. When there are indications of lead exposure above the action level
    D. When the PEL is exceeded
5. When must medical surveillance be made available for lead exposures?
    A. When the action level is exceeded
    B. When the action level is exceeded for 30 days in a year
    C. When the PEL is exceeded
    D. When the PEL is exceeded for 30 days in a year
6. When is respiratory protection required for lead exposures?
    A. When the action level is exceeded
    B. When the action level is exceeded for 30 days in a year
    C. When engineering controls do not reduce exposure below the PEL

D. When the PEL is exceeded for 30 days in a year

7. What respiratory protection is considered acceptable for protection against lead exposures?

   A. Air-purifying with organic vapor cartridge

   B. Air-purifying with HEPA cartridge

   C. Air-purifying with lead cartridge

   D. Supplied-air respirator is the only acceptable respiratory protection

8. What are the requirements for entering a lead-regulated area?

   A. Must be an authorized person

   B. Must complete lead training

   C. Must wear protective clothing

   D. All of the above

9. What control measure should be used to minimize dust formation when disturbing lead-containing soil?"

   A. Training

   B. Wetting the soil

   C. Air purifying respirators

   D. None of the above

10. What level of lead in the soil might require a lead blood test?

    A. 1% or 10,000 ppm

    B. 3% or 30.000 ppm

    C. 5% or 50,000 ppm

    D. None of the above

APPENDIX B

# CH2M HILL Site-Specific Checklists

# Site-Specific Investigation-Derived Waste Plan Checklist

This checklist supplements the Master IDW Plan with site-specific information. Once completed for a specific project, it provides necessary IDW information for each investigation. It is to be taken into the field with the Master IDW Plan.

Sites: AOC R at the Former NASD

1. IDW Media:
   - X Soil cuttings
   - X Well development or purge water
   - X Decontamination residual soil and wastewater
   - X PPE or disposable equipment
   - _____ Other _____

2. Expected Regulatory Status:
   - X Hazardous
   - _____ Solid Waste
   - _____ Unknown
   - _____ Other _____

3. Site Locations: AOC-R – Former Staging Area

4. Nature of Contaminants Expected:
   - X Petroleum contamination
   - X Polyaromatic hydrocarbon
   - _____ Pesticides
   - _____ Herbicides
   - _____ PCBs
   - X Metals
   - _____ Other _____

5. Volume of IDW Expected:
   - 30 Drums
   - _____ Cubic Yards
   - _____ Tons
   - _____ Gallons

6. Compositing Strategy for Sample Collection: composite borings

7. IDW Storage
   - _____ As per Master IDW Plan
   - X Other Bldg 2015

8. Waste Disposal
   - X As per Master IDW Plan
   - _____ Other _____

# Site-Specific Quality Assurance Project Plan Checklist

This checklist supplements the Master QAPP with site-specific information. Once completed for a specific project, it provides necessary quality assurance information for each investigation. It is to be taken into the field with the Master QAPP.

Sites: AOC-R at the Former NASD

1. List sampling tasks: Collect surface soil, subsurface soil, and groundwater samples.

2. List data quality objectives: Meet EPA Region IX PRG screening levels.

3. Organization:

| | |
|---|---|
| LANTDIV IR Section Head | Byron Brandt |
| LANTDIV Navy Technical Representative | Jeff Harlow |
| USEPA Remedial Project Manager | Daniel Rodriguez |
| VDEQ Federal Facilities Project Manager | Yarissa Martinez |
| CH2M HILL Activity Manager | John Tomik |
| Quality Control Senior Review | Brett Doerr |
| Technical Project Manager | Brett Doerr |
| Field Team Leader | Kenji Butler |

4. Table of samples with analyses to be performed and associated QC samples (attached): see section 4 of this work plan.

5. Analytical Quantitation Limits:
   X As per Tables 8-2 and 8-3 of Master QAPP _____ Other (attached)

6. QA/QC Acceptance Criteria (e.g., precision, accuracy)
   X As per Table 4-1 of Master QAPP _____ Other (attached)

7. Data reduction, validation, and reporting:
   X As per Section 9 of Master QAPP _____ Other (attached)

8. Internal QC Procedures (field and laboratory):
   X As per Section 10 of Master QAPP _____ Other (attached)

9. Corrective Action:
   X As per Section 14 of Master QAPP _____ Other (attached)

10. Other deviations from Master QAPP _____

# Site-Specific Field Sampling Plan Checklist

This checklist supplements the Master Field Sampling Plan with site-specific information. Once completed for a specific project, it provides necessary field sampling information for each investigation. It is to be taken into the field with the Master FSP.

Sites: AOC-I and AOC-R

1. Tasks to be performed:

| | |
|---|---|
| _____Geophysical surveys | X_____Groundwater sampling |
| _____Soil gas surveys | _____In-situ groundwater sampling |
| _____Surface water and sediment sampling | X_____Aquifer testing |
| | _____Hydrogeologic measurements |
| X_____Surface soil sampling | _____Biota sampling |
| X_____Soil boring installation | _____Trenching |
| X_____Subsurface soil sampling | X_____Land surveying |
| X_____Monitoring well installation and development | X_____Investigation derived waste sampling |
| | X_____Decontamination |
| _____Monitoring well abandonment | _____Other_____ |

2. Field measurements to be taken:

| | |
|---|---|
| X_____temperature | X_____surveying |
| X_____pH | _____magnetometry |
| X_____dissolved oxygen | _____global positioning system |
| X_____turbidity | _____soil gas parameters (list): |
| X_____specific conductance | _____combustible gases |
| X_____organic vapor monitoring | X_____water-level measurements |
| _____geophysical parameters (list): | X_____pumping rate |
| _____electromagnetic induction | X_____other oxidation reduction potential (ORP) |
| _____ground-penetrating radar | |

3. Sampling program (nomenclature, etc.):

_____As per Section 3.1 of Master FSP X_____Other as per section 4.5.6 of this plan

4. Map of boring and sampling locations (attach to checklist): Figures 4-1 thru 4-4 of this Site Specific Work Plan

5. Table of field samples to be collected: Tables 4-4, 4-5, 4-7, and 4-8 of this Site Specific Work Plan

6. Applicable SOPs (attach to checklist) or references to specific pages in Master FSP: The following SOPs from the Master Work Plan are to be implemented:

- Shallow Soil Sampling

- Soil Sampling
- Soil Boring Sampling- Split Spoon
- Groundwater Sampling From Monitoring Wells
- Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling
- Installation of Shallow Monitoring Wells
- Homogenization of Soil and Sediment Samples
- VOC Sampling – Water
- Field Filtering
- Chain-of-Custody
- Equipment Blank and Field Blank Preparation
- Soil Boring Drilling and Abandonment
- Water Level Measurements
- Logging of Soil Borings
- Decontamination of Personnel and Equipment
- Decontamination of Drilling Rigs and Equipment
- Disposal of Waste Fluids and Soil
- Aquifer Slug Testing

7. Site-specific procedures or updates to protocols established in the Master FSP:

Described in the RI/FS Work Plan

# Site-Specific Health and Safety Plan

This checklist must be used in conjunction with the Master HASP. This checklist is intended for use by CH2M HILL employees only. All CH2M HILL employees performing tasks under this checklist must read and sign both this checklist and the Master HASP and agree to abide by their provisions (see EMPLOYEE SIGNOFF attached to the checklist.

Sites: AOC-R at the Former NASD (West Vieques)

Location(s) Site maps for AOC-R are included as Figures 1-2, 1-3, and 1-4 of the Site Specific Work Plan

This document shall be maintained on site with the Master Health and Safety Plan. It will include as attachments from the Work Plan a site map and the site characterization and objectives for this site.

The procedures described in the Master Health and Safety Plan will be followed unless otherwise specified in this Site-Specific Health and Safety Plan.

1. HAZWOPER-Regulated Tasks

| | |
|---|---|
| ____ Test pit and excavation | X Groundwater sampling |
| X Soil boring installation | ____ Aquifer testing |
| ____ Geoprobe boring | X Hydrologic measurements |
| ____ Geophysical surveys | ____ Surface water sampling |
| X Hand augering | ____ Biota sampling |
| X Subsurface soil sampling | X Investigation-derived waste (drum) sampling and disposal |
| X Surface soil sampling | ____ Observation of loading of material for offsite disposal |
| ____ Soil gas surveys | ____ Oversight of remediation and construction |
| ____ Sediment sampling | ____ Other____ |
| X Monitoring well/drive point installation | |
| ____ Monitoring well abandonment | |

2. Hazards of Concern: (Check as many as are applicable. Refer to Section 3 of Master H&S Plan for control measures):

| | |
|---|---|
| X Heat stress | ____ Confined space entry |
| X Cold stress | ____ Trenches, excavations |
| ____ Buried utilities, drums, tanks | ____ Protruding objects |
| ____ Inadequate illumination | ____ Vehicle traffic |
| X Drilling | ____ Ladders, scaffolds |
| ____ Heavy equipment | ____ Fire |
| ____ Working near water | ____ Working on water |
| ____ Flying debris | X Bees or insects |
| ____ Gas cylinders | ____ Poison ivy, oak, sumac |
| X Noise | X Ticks |
| X Slip, trip, or fall hazards | ____ Radiological |
| X Back injury | ____ Other____ |

3. Contaminants of Concern (List if known. Reduce Table 3.8 of the Master HASP to site-specific contaminants, add additional chemicals if necessary, and attach to this checklist):

Metals SVOCs TPH

4. Personnel (List CH2M HILL field team members and telephone numbers):

Field team leader(s) Kenji Butler

Site safety coordinator(s) Lisa Carter

Field team members TBD

5. Contractors/Subcontractors

X Procedures as per Master HASP

X Other Contractors awarded after bidding for drilling, surveying, brush clearance

Name: TBD

Contact: TBD

Telephone: TBD

6. Level of personal protective equipment (PPE) required: Level D
Refer to Table 5.1 of Master HASP, CH2M HILL SOPs HS-07 and HS-08, and Respiratory Protection, Section 2 of the Site Safety Notebook.

7. Air monitoring instruments to be used:

X OVM 10.6 ____FID

____CGI ____Dust monitor

____$O_2$

8. Decontamination procedures:

____As per Section 7 of Master HASP

X Other As described in this Site Specific Work Plan

9. List any other deviations or variations from the Master HASP: None

10. Map to hospital (Highlight route to hospital from site and attach to this checklist)

11. Emergency Contacts (Check that all names and numbers are correct and attach corrected page to this checklist)

12. Approval. This prepared site-specific checklist must be approved by Mike Goldman/ATL or his authorized representative

    (Signature will be included in the Final HASP)

13. Employee Signoff. All CH2M HILL employees working at the site must sign the attached Employee Signoff for the checklist as well as for the Master HASP.

_____Site

**HASP Checklist Employee Signoff**

The employees listed below have been given a copy of this health and safety plan checklist, have read and understood it, and agree to abide by its provisions.

| EMPLOYEE NAME | EMPLOYEE SIGNATURE AND DATE |
|---|---|
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## 9.8 Emergency Contacts (complete during project start-up)

### 24-hour CH2M HILL Emergency Beeper – 888/444-1226

**Medical Emergency – 911**
Facility Medical Response # (787) 741-3992
Local Ambulance #: (787) 741-2151

**CH2M HILL Medical Consultant**
Dr. Peter Greaney
GMG WorkCare, Orange, CA
800/455-6155
(After hours calls will be returned within 20 minutes)

**Fire/Spill Emergency -- 911**
Facility Fire Response #:
Local Fire Dept #: (787) 741-2111

**Local Occupational Physician**

**Security & Police – 911**
Facility Security #:
Local Police #: (787) 741-2020

**Corporate Director Health and Safety**
Name: Mollie Netherland/SEA
Phone: 206/453-5005
24-hour emergency beeper: 888-444-1226

**Utilities Emergency**
Water: (787) 741-2001
Gas:
Electric:

**Health and Safety Manager (HSM)**
Name: Michael Goldman
Phone: 770/604-9182 (office) ext 396;
Home; 404/872-6081 (home)

**Site Safety Coordinator (SSC)**
Name: Lisa Carter
Phone: (703) 471-6405

**Regional Human Resources Department**
Name: Mary Jo Jordan
Phone: 352/335-5877

**Project Manager**
Name: Brett Doerr
Phone: (757) 671-8311, Ext. 414

**Corporate Human Resources Department**
Name: John Monark/COR
Phone: 303/771-0900

**Federal Express Dangerous Goods Shipping**
Phone: 800/238-5355
**CH2M HILL Emergency Number for Shipping Dangerous Goods**
Phone: 800/255-3924

**Worker's Compensation and Auto Claims**
Sterling Administration Services
Phone: 800/420-8926 After hours: 800/497-4566

Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.

**Federal Agency / Contact Name:** **Phone:**
**State Agency / Contact Name:** **Phone:**
**Local Agency / Contact Name:** **Phone:**
Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

**Facility Alarms:** N/A **Evacuation Assembly Area(s):**

**Facility/Site Evacuation Route(s):** Route 997 north to hospital

**Hospital Name/Address:** Vieques Municipal **Hospital Phone #:** (787) 741-2151

### Directions to Hospital

Vieques Hospital is located on Route 997. From NASD, take Highway 200 east to Route 997 ( about 6 miles to 3rd ESSO on corner) turn right on Route 997 (south) and proceed about 0.5 miles to hospital on the left.

# Site-Specific Work Plan Checklist

This checklist supplements the Master Work Plan (WP) with site-specific information. Once completed for a specific project, it provides necessary quality assurance information for each investigation. It is to be taken into the field with the Master WP.

Site(s): AOC-R at the Former NASD (West Vieques)

1. Discussion of site background, previous investigations, and previous analytical results:

Described in Section 2 of this Site Specific Work Plan

2. Description of site-specific geology, topography, water table elevation, and local direction of groundwater flow:

Available information is included in Section 2 of this Site Specific Work Plan.

3. Map illustrating the area of investigation in relation to the entire Base:

Figure 1-2 of this Site Specific Work Plan

4. Discussion of the field investigation and activities to be performed at the site, including methods, locations, and types of drilling, sampling, and analyses to be performed:

Section 4 of this Site Specific Work Plan

5. Map illustrating boring, well, and sample locations:

Figures 4-1 through 4-4 of this Site Specific Work Plan

6. Description of the feasibility study tasks to be performed at the site:

Sections 6 and 7 of this Site Specific Work Plan

7. Explanation of staff organization and task order management:

Section 9 of this Site Specific Work Plan

8. Task order schedule:

Section 8 of this Site Specific Work Plan

APPENDIX C

# Screening Criteria

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C / skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| 8.7E-03 | i | 4.0E-03 | i | 8.7E-03 | r | 4.0E-03 | r | 0.1 | 30560-19-1 | Acephate | 5.6E+01 | ca** | 2.0E+02 | ca* | 7.7E-01 | ca* | 7.7E+00 | ca* | | |
| | | | | 7.7E-03 | i | 2.6E-03 | i | y | 75-07-0 | Acetaldehyde | 1.1E+01 | ca** | 2.3E+01 | ca** | 8.7E-01 | ca* | 1.7E+00 | ca | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 34256-82-1 | Acetochlor | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 9.0E-01 | i | | | 9.0E-01 | r | y | 67-64-1 | **Acetone** | 1.4E+04 | nc | 5.4E+04 | nc | 3.3E+03 | nc | 5.5E+03 | nc | 1.6E+01 | 8.0E-01 |
| | | 8.0E-04 | h | | | 8.0E-04 | r | 0.1 | 75-86-5 | Acetone cyanohydrin | 4.9E+01 | nc | 4.9E+02 | nc | 2.9E+00 | nc | 2.9E+01 | nc | | |
| | | 1.7E-02 | r | | | 1.7E-02 | i | y | 75-05-8 | Acetonitrile | 4.2E+02 | nc | 1.8E+03 | nc | 6.2E+01 | nc | 1.0E+02 | nc | | |
| | | 5.0E-04 | i | | | 5.7E-06 | i | y | 107-02-8 | **Acrolein** | 1.0E-01 | nc | 3.4E-01 | nc | 2.1E-02 | nc | 4.2E-02 | nc | | |
| 4.5E+00 | i | 2.0E-04 | i | 4.5E+00 | i | 2.0E-04 | r | 0.1 | 79-06-1 | Acrylamide | 1.1E-01 | ca | 3.8E-01 | ca | 1.5E-03 | ca | 1.5E-02 | ca | | |
| | | 5.0E-01 | i | | | 2.9E-04 | i | 0.1 | 79-10-7 | Acrylic acid | 2.9E+04 | nc | 1.0E+05 | max | 1.0E+00 | nc | 1.8E+04 | nc | | |
| 5.4E-01 | i | 1.0E-03 | h | 2.4E-01 | i | 5.7E-04 | i | y | 107-13-1 | Acrylonitrile | 2.1E-01 | ca* | 4.9E-01 | ca* | 2.8E-02 | ca* | 3.9E-02 | ca* | | |
| 1.0E+00 | r | | | 1.0E+00 | c | | | y | | **"CAL-Modified PRG"** | 5.5E-02 | ca | 1.2E-01 | ca | 6.7E-03 | ca | 1.1E-02 | ca | | |
| 8.1E-02 | h | 1.0E-02 | i | 8.0E-02 | r | 1.0E-02 | r | 0.1 | 15972-60-8 | Alachlor | 6.0E+00 | ca | 2.1E+01 | ca | 8.4E-02 | ca | 8.4E-01 | ca | | |
| | | 1.5E-01 | i | | | 1.5E-01 | r | 0.1 | 1596-84-5 | Alar | 9.2E+03 | nc | 9.2E+04 | nc | 5.5E+02 | nc | 5.5E+03 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0.1 | 116-06-3 | Aldicarb | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0.1 | 1646-88-4 | Aldicarb sulfone | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| 1.7E+01 | i | 3.0E-05 | i | 1.7E+01 | i | 3.0E-05 | r | 0.1 | 309-00-2 | Aldrin | 2.9E-02 | ca* | 1.0E-01 | ca | 3.9E-04 | ca | 4.0E-03 | ca | 5.0E-01 | 2.0E-02 |
| | | 2.5E-01 | i | | | 2.5E-01 | r | 0.1 | 74223-64-6 | Ally | 1.5E+04 | nc | 1.0E+05 | max | 9.1E+02 | nc | 9.1E+03 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0.1 | 107-18-6 | Allyl alcohol | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.9E-04 | r | | | 2.9E-04 | i | 0.1 | 107-05-1 | **Allyl chloride** | 1.7E+01 | nc | 1.8E+02 | nc | 1.0E+00 | nc | 1.0E+01 | nc | | |
| | | 1.0E+00 | p | | | 1.4E-03 | p | | 7429-90-5 | Aluminum | 7.6E+04 | nc | 1.0E+05 | max | 5.1E+00 | nc | 3.6E+04 | nc | | |
| | | 4.0E-04 | i | | | | | | 20859-73-8 | Aluminum phosphide | 3.1E+01 | nc | 4.1E+02 | nc | | | 1.5E+01 | nc | | |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0.1 | 67485-29-4 | Amdro | 1.8E+01 | nc | 1.8E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| | | 9.0E-03 | i | | | 9.0E-03 | r | 0.1 | 834-12-8 | Ametryn | 5.5E+02 | nc | 5.5E+03 | nc | 3.3E+01 | nc | 3.3E+02 | nc | | |
| | | 2.0E-04 | n | | | 2.0E-04 | r | 0.1 | 1321-12-6 | **Aminodinitrotoluene** | 1.2E+01 | nc | 1.2E+02 | nc | 7.3E-01 | nc | 7.3E+00 | nc | | |
| | | 7.0E-02 | h | | | 7.0E-02 | r | 0.1 | 591-27-5 | m-Aminophenol | 4.3E+03 | nc | 4.3E+04 | nc | 2.6E+02 | nc | 2.6E+03 | nc | | |
| | | 2.0E-05 | h | | | 2.0E-05 | r | 0.1 | 504-24-5 | 4-Aminopyridine | 1.2E+00 | nc | 1.2E+01 | nc | 7.3E-02 | nc | 7.3E-01 | nc | | |
| | | 2.5E-03 | i | | | 2.5E-03 | r | 0.1 | 33089-61-1 | Amitraz | 1.5E+02 | nc | 1.5E+03 | nc | 9.1E+00 | nc | 9.1E+01 | nc | | |
| | | | | | | 2.9E-02 | i | | 7664-41-7 | Ammonia | | | | | 1.0E+02 | nc | | | | |
| | | 2.0E-01 | i | | | | | 0.1 | 7773-06-0 | Ammonium sulfamate | 1.2E+04 | nc | 1.0E+05 | max | | | 7.3E+03 | nc | | |
| 5.7E-03 | i | 7.0E-03 | p | 5.7E-03 | r | 2.9E-04 | i | 0.1 | 62-53-3 | Aniline | 8.5E+01 | ca** | 3.0E+02 | ca* | 1.0E+00 | nc | 1.2E+01 | ca* | | |
| | | 4.0E-04 | i | | | | | | 7440-36-0 | Antimony and compounds | 3.1E+01 | nc | 4.1E+02 | nc | | | 1.5E+01 | nc | 5.0E+00 | 3.0E-01 |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0.1 | 74115-24-5 | Apollo | 7.9E+02 | nc | 8.0E+03 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| 2.5E-02 | i | 5.0E-02 | h | 2.5E-02 | i | 5.0E-02 | r | 0.1 | 140-57-8 | Aramite | 1.9E+01 | ca | 6.9E+01 | ca | 2.7E-01 | ca | 2.7E+00 | ca | | |
| 1.5E+00 | i | 3.0E-04 | i | 1.5E+01 | i | | | 0.03 | 7440-38-2 | Arsenic | 3.9E-01 | ca* | 1.6E+00 | ca | 4.5E-04 | ca | 4.5E-02 | ca | 2.9E+01 | 1.0E+00 |
| 9.5E+00 | c | | | 1.2E+01 | c | | | 0.03 | | **"CAL-Modified PRG"** | 6.2E-02 | ca | 2.5E-01 | ca | 5.6E-04 | ca | 7.1E-03 | ca | | |
| | | | | | | 1.4E-05 | i | | 7784-42-1 | Arsine (see arsenic for cancer endpoint) | | | | | 5.2E-02 | nc | | | | |
| | | 9.0E-03 | i | | | 9.0E-03 | r | 0.1 | 76578-14-8 | Assure | 5.5E+02 | nc | 5.5E+03 | nc | 3.3E+01 | nc | 3.3E+02 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 3337-71-1 | Asulam | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| 2.2E-01 | h | 3.5E-02 | i | 2.2E-01 | r | 3.5E-02 | r | 0.1 | 1912-24-9 | Atrazine | 2.2E+00 | ca | 7.8E+00 | ca | 3.1E-02 | ca | 3.0E-01 | ca | | |
| | | 4.0E-04 | i | | | 4.0E-04 | r | 0.1 | 71751-41-2 | Avermectin B1 | 2.4E+01 | nc | 2.5E+02 | nc | 1.5E+00 | nc | 1.5E+01 | nc | | |
| 1.1E-01 | i | | | 1.1E-01 | i | | | 0.1 | 103-33-3 | Azobenzene | 4.4E+00 | ca | 1.6E+01 | ca | 6.2E-02 | ca | 6.1E-01 | ca | | |
| | | 7.0E-02 | i | | | 1.4E-04 | h | | 7440-39-3 | Barium and compounds | 5.4E+03 | nc | 6.7E+04 | nc | 5.2E-01 | nc | 2.6E+03 | nc | 1.6E+03 | 8.2E+01 |

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| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C / skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0.1 | 114-26-1 | Baygon | 2.4E+02 | nc | 2.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0.1 | 43121-43-3 | Bayleton | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0.1 | 68359-37-5 | Baythroid | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 3.0E-01 | i | | | 3.0E-01 | r | 0.1 | 1861-40-1 | Benefin | 1.8E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.1E+04 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 17804-35-2 | Benomyl | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0.1 | 25057-89-0 | Bentazon | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0.1 | 100-52-7 | Benzaldehyde | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| 5.5E-02 | i | 4.0E-03 | i | 2.7E-02 | i | 8.6E-03 | i | y | 71-43-2 | **Benzene** | 6.4E-01 | ca* | 1.4E+00 | ca* | 2.5E-01 | ca | 3.5E-01 | ca | 3.0E-02 | 2.0E-03 |
| 2.3E+02 | i | 3.0E-03 | i | 2.3E+02 | i | 3.0E-03 | r | 0.1 | 92-87-5 | Benzidine | 2.1E-03 | ca | 7.5E-03 | ca | 2.9E-05 | ca | 2.9E-04 | ca | | |
| | | 4.0E+00 | i | | | 4.0E+00 | r | 0.1 | 65-85-0 | Benzoic acid | 1.0E+05 | max | 1.0E+05 | max | 1.5E+04 | nc | 1.5E+05 | nc | 4.0E+02 | 2.0E+01 |
| 1.3E+01 | i | | | 1.3E+01 | r | | | 0.1 | 98-07-7 | Benzotrichloride | 3.7E-02 | ca | 1.3E-01 | ca | 5.2E-04 | ca | 5.2E-03 | ca | | |
| | | 3.0E-01 | h | | | 3.0E-01 | r | 0.1 | 100-51-6 | Benzyl alcohol | 1.8E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.1E+04 | nc | | |
| 1.7E-01 | i | 2.9E-03 | r | 1.7E-01 | r | 2.9E-03 | n | y | 100-44-7 | Benzyl chloride | 8.9E-01 | ca* | 2.2E+00 | ca | 4.0E-02 | ca | 6.6E-02 | ca | | |
| | | 2.0E-03 | i | 8.4E+00 | i | 5.7E-06 | i | | 7440-41-7 | Beryllium and compounds | 1.5E+02 | nc | 1.9E+03 | ca** | 8.0E-04 | ca* | 7.3E+01 | nc | 6.3E+01 | 3.0E+00 |
| | | 1.0E-04 | i | | | 1.0E-04 | r | 0.1 | 141-66-2 | Bidrin | 6.1E+00 | nc | 6.2E+01 | nc | 3.7E-01 | nc | 3.6E+00 | nc | | |
| | | 1.5E-02 | i | | | 1.5E-02 | r | 0.1 | 82657-04-3 | Biphenthrin (Talstar) | 9.2E+02 | nc | 9.2E+03 | nc | 5.5E+01 | nc | 5.5E+02 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | y | 92-52-4 | **1,1-Biphenyl** | 3.0E+03 | nc | 2.3E+04 | nc | 1.8E+02 | nc | 3.0E+02 | nc | | |
| 1.1E+00 | i | | | 1.1E+00 | i | | | y | 111-44-4 | Bis(2-chloroethyl)ether | 2.2E-01 | ca | 5.8E-01 | ca | 6.1E-03 | ca | 1.0E-02 | ca | 4.0E-04 | 2.0E-05 |
| 7.0E-02 | x | 4.0E-02 | i | 3.5E-02 | x | 4.0E-02 | r | y | 108-60-1 | Bis(2-chloroisopropyl)ether | 2.9E+00 | ca | 7.4E+00 | ca | 1.9E-01 | ca | 2.7E-01 | ca | | |
| 2.2E+02 | i | | | 2.2E+02 | i | | | y | 542-88-1 | Bis(chloromethyl)ether | 1.9E-04 | ca | 4.3E-04 | ca | 3.1E-05 | ca | 5.2E-05 | ca | | |
| 7.0E-02 | x | 4.0E-02 | i | 3.5E-02 | x | 4.0E-02 | r | y | 108-60-1 | Bis(2-chloro-1-methylethyl)ether | 2.9E+00 | ca | 7.4E+00 | ca | 1.9E-01 | ca | 2.7E-01 | ca | | |
| 1.4E-02 | i | 2.0E-02 | i | 1.4E-02 | r | 2.0E-02 | r | 0.1 | 117-81-7 | Bis(2-ethylhexyl)phthalate (DEHP) | 3.5E+01 | ca* | 1.2E+02 | ca | 4.8E-01 | ca | 4.8E+00 | ca | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 80-05-7 | Bisphenol A | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 2.00E-01 | i | | | 5.7E-03 | h | | 7440-42-8 | Boron | 1.6E+04 | nc | 1.0E+05 | max | 2.1E+01 | nc | 7.3E+03 | nc | | |
| | | | | | | 2.0E-04 | h | | 7637-07-2 | Boron trifluoride | | | | | 7.3E-01 | nc | | | | |
| 7.0E-01 | i | 4.0E-03 | i | 7.0E-01 | r | 4.0E-03 | r | 0.1 | 15541-45-4 | **Bromate** | 6.9E-01 | ca | 2.5E+00 | ca | 9.6E-03 | ca | 9.6E-02 | ca | | |
| | | 2.0E-02 | p | | | 2.9E-03 | p | y | 108-86-1 | Bromobenzene | 2.8E+01 | nc | 9.2E+01 | nc | 1.0E+01 | nc | 2.0E+01 | nc | | |
| 6.2E-02 | i | 2.0E-02 | i | 6.2E-02 | r | 2.0E-02 | r | y | 75-27-4 | Bromodichloromethane | 8.2E-01 | ca | 1.8E+00 | ca | 1.1E-01 | ca | 1.8E-01 | ca | 6.0E-01 | 3.0E-02 |
| 7.9E-03 | i | 2.0E-02 | i | 3.9E-03 | i | 2.0E-02 | r | 0.1 | 75-25-2 | Bromoform (tribromomethane) | 6.2E+01 | ca* | 2.2E+02 | ca* | 1.7E+00 | ca* | 8.5E+00 | ca* | 8.0E-01 | 4.0E-02 |
| | | 1.4E-03 | i | | | 1.4E-03 | i | y | 74-83-9 | Bromomethane (Methyl bromide) | 3.9E+00 | nc | 1.3E+01 | nc | 5.2E+00 | nc | 8.7E+00 | nc | 2.0E-01 | 1.0E-02 |
| | | 5.0E-03 | h | | | 5.0E-03 | r | 0.1 | 2104-96-3 | Bromophos | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 1689-84-5 | Bromoxynil | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 1689-99-2 | Bromoxynil octanoate | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| 1.1E-01 | r | 5.7E-04 | r | 1.1E-01 | i | 5.7E-04 | i | y | 106-99-0 | **1,3-Butadiene** | 5.8E-02 | ca* | 1.2E-01 | ca* | 6.1E-02 | ca* | 1.0E-01 | ca* | | |
| 6.0E-01 | r | 5.7E-03 | r | 6.0E-01 | c | 5.7E-03 | c | y | 106-99-0 | **"CAL-Modified PRG"** | 1.1E-02 | ca | 2.3E-02 | ca | 1.1E-02 | ca | 1.9E-02 | ca | | |
| | | 1.0E-01 | i | | | 2.6E-03 | n | 0.1 | 71-36-3 | 1-Butanol | 6.1E+03 | nc | 6.1E+04 | nc | 9.5E+00 | nc | 3.6E+03 | nc | 1.7E+01 | 9.0E-01 |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 2008-41-5 | Butylate | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 4.0E-02 | n | | | 4.0E-02 | r | y | 104-51-8 | n-Butylbenzene | 2.4E+02 | sat | 2.4E+02 | sat | 1.5E+02 | nc | 2.4E+02 | nc | | |
| | | 4.0E-02 | n | | | 4.0E-02 | r | y | 135-9-88 | sec-Butylbenzene | 2.2E+02 | sat | 2.2E+02 | sat | 1.5E+02 | nc | 2.4E+02 | nc | | |
| | | 4.0E-02 | n | | | 4.0E-02 | r | y | 98-06-6 | tert-Butylbenzene | 3.9E+02 | sat | 3.9E+02 | sat | 1.5E+02 | nc | 2.4E+02 | nc | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r | 0.1 | 85-68-7 | Butyl benzyl phthalate | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | 9.3E+02 | 8.1E+02 |
| | | 1.0E+00 | i | | | 1.0E+00 | r | 0.1 | 85-70-1 | Butylphthalyl butylglycolate | 6.1E+04 | nc | 1.0E+05 | max | 3.7E+03 | nc | 3.6E+04 | nc | | |

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| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C / skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 5.0E-04 | i | 6.3E+00 | i | | | 0.001 | 7440-43-9 | Cadmium and compounds | 3.7E+01 | nc | 4.5E+02 | nc | 1.1E-03 | ca | 1.8E+01 | nc | 8.0E+00 | 4.0E-01 |
| | | 5.0E-01 | i | | | 5.0E-01 | r | 0.1 | 105-60-2 | Caprolactam | 3.1E+04 | nc | 1.0E+05 | max | 1.8E+03 | nc | 1.8E+04 | nc | | |
| 8.6E-03 | h | 2.0E-03 | i | 8.6E-03 | r | 2.0E-03 | r | 0.1 | 2425-06-1 | Captafol | 5.7E+01 | ca** | 2.0E+02 | ca** | 7.8E-01 | ca** | 7.8E+00 | ca** | | |
| 3.5E-03 | h | 1.3E-01 | i | 3.5E-03 | r | 1.3E-01 | r | 0.1 | 133-06-2 | Captan | 1.4E+02 | ca* | 4.9E+02 | ca | 1.9E+00 | ca | 1.9E+01 | ca | | |
| | | 1.0E-01 | i | | | 1.1E-01 | r | 0.1 | 63-25-2 | Carbaryl | 6.1E+03 | nc | 6.2E+04 | nc | 4.0E+02 | nc | 3.6E+03 | nc | | |
| 2.0E-02 | h | | | 2.0E-02 | r | | | 0.1 | 86-74-8 | Carbazole | 2.4E+01 | ca | 8.6E+01 | ca | 3.4E-01 | ca | 3.4E+00 | ca | 6.0E-01 | 3.0E-02 |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0.1 | 1563-66-2 | Carbofuran | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 1.0E-01 | i | | | 2.0E-01 | i | y | 75-15-0 | Carbon disulfide | 3.6E+02 | nc | 7.2E+02 | sat | 7.3E+02 | nc | 1.0E+03 | nc | 3.2E+01 | 2.0E+00 |
| 1.3E-01 | i | 7.0E-04 | i | 5.3E-02 | i | 7.0E-04 | r | y | 56-23-5 | Carbon tetrachloride | 2.5E-01 | ca** | 5.5E-01 | ca* | 1.3E-01 | ca* | 1.7E-01 | ca* | 7.0E-02 | 3.0E-03 |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 55285-14-8 | Carbosulfan | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0.1 | 5234-68-4 | Carboxin | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 1.5E-02 | i | | | 1.5E-02 | r | 0.1 | 133-90-4 | Chloramben | 9.2E+02 | nc | 9.2E+03 | nc | 5.5E+01 | nc | 5.5E+02 | nc | | |
| 4.0E-01 | h | | | 4.0E-01 | r | | | 0.1 | 118-75-2 | Chloranil | 1.2E+00 | ca | 4.3E+00 | ca | 1.7E-02 | ca | 1.7E-01 | ca | | |
| 3.5E-01 | i | 5.0E-04 | i | 3.5E-01 | i | 2.0E-04 | i | 0.04 | 12789-03-6 | Chlordane (technical) | 1.6E+00 | ca* | 6.5E+00 | ca* | 1.9E-02 | ca* | 1.9E-01 | ca* | 1.0E+01 | 5.0E-01 |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 90982-32-4 | Chlorimuron-ethyl | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.0E-01 | i | | | 5.7E-05 | n | | 7782-50-5 | Chlorine | | | | | 2.1E-01 | nc | | | | |
| | | 3.0E-02 | i | | | 5.7E-05 | i | | 10049-04-4 | Chlorine dioxide | | | | | 2.1E-01 | nc | | | | |
| | | 2.0E-03 | h | | | 2.0E-03 | r | 0.1 | 79-11-8 | Chloroacetic acid | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 8.6E-06 | r | | | 8.6E-06 | i | y | 532-27-4 | 2-Chloroacetophenone | 3.3E-02 | nc | 1.1E-01 | nc | 3.1E-02 | nc | 5.2E-02 | nc | | |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0.1 | 106-47-8 | 4-Chloroaniline | 2.4E+02 | nc | 2.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | 7.0E-01 | 3.0E-02 |
| | | 2.0E-02 | i | | | 1.7E-02 | n | y | 108-90-7 | Chlorobenzene | 1.5E+02 | nc | 5.3E+02 | nc | 6.2E+01 | nc | 1.1E+02 | nc | 1.0E+00 | 7.0E-02 |
| 2.7E-01 | h | 2.0E-02 | i | 2.7E-01 | h | 2.0E-02 | r | 0.1 | 510-15-6 | Chlorobenzilate | 1.8E+00 | ca | 6.4E+00 | ca | 2.5E-02 | ca | 2.5E-01 | ca | | |
| | | 2.0E-01 | h | | | 2.0E-01 | r | 0.1 | 74-11-3 | p-Chlorobenzoic acid | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |
| | | 2.0E-02 | h | | | 2.0E-02 | r | 0.1 | 98-56-6 | 4-Chlorobenzotrifluoride | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-02 | h | | | 2.0E-03 | h | y | 126-99-8 | 2-Chloro-1,3-butadiene | 3.6E+00 | nc | 1.2E+01 | nc | 7.3E+00 | nc | 1.4E+01 | nc | | |
| | | 4.0E-01 | h | | | 4.0E-01 | r | y | 109-69-3 | 1-Chlorobutane | 4.8E+02 | sat | 4.8E+02 | sat | 1.5E+03 | nc | 2.4E+03 | nc | | |
| | | 1.4E+01 | r | | | 1.4E+01 | i | y | 75-68-3 | 1-Chloro-1,1-difluoroethane (HCFC-142b) | 3.4E+02 | sat | 3.4E+02 | sat | 5.2E+04 | nc | 8.7E+04 | nc | | |
| | | 1.4E+01 | r | | | 1.4E+01 | i | y | 75-45-6 | Chlorodifluoromethane | 3.4E+02 | sat | 3.4E+02 | sat | 5.1E+04 | nc | 8.5E+04 | nc | | |
| 2.9E-03 | n | 4.0E-01 | n | 2.9E-03 | r | 2.9E+00 | i | y | 75-00-3 | Chloroethane | 3.0E+00 | ca | 6.5E+00 | ca | 2.3E+00 | ca | 4.6E+00 | ca | | |
| | | 1.0E-02 | i | 8.1E-02 | i | 1.4E-02 | n | y | 67-66-3 | **Chloroform** | 2.2E-01 | ca | 4.7E-01 | ca | 8.3E-02 | ca | 1.7E-01 | ca | 6.0E-01 | 3.0E-02 |
| 3.1E-02 | c | | | 1.9E-02 | c | | | y | | "CAL-Modified PRG" | 9.4E-01 | ca | 2.0E+00 | ca | 3.5E-01 | ca | 5.3E-01 | ca | | |
| | | 2.6E-02 | r | | | 2.6E-02 | i | y | 74-87-3 | **Chloromethane (methyl chloride)** | 4.7E+01 | nc | 1.6E+02 | nc | 9.5E+01 | nc | 1.6E+02 | nc | | |
| 5.8E-01 | h | | | 5.8E-01 | r | | | 0.1 | 95-69-2 | 4-Chloro-2-methylaniline | 8.4E-01 | ca | 3.0E+00 | ca | 1.2E-02 | ca | 1.2E-01 | ca | | |
| 4.6E-01 | h | | | 4.6E-01 | r | | | 0.1 | 3165-93-3 | 4-Chloro-2-methylaniline hydrochloride | 1.1E+00 | ca | 3.7E+00 | ca | 1.5E-02 | ca | 1.5E-01 | ca | | |
| | | 8.0E-02 | i | | | 8.0E-02 | r | y | 91-58-7 | beta-Chloronaphthalene | 4.9E+03 | nc | 2.3E+04 | nc | 2.9E+02 | nc | 4.9E+02 | nc | | |
| 9.7E-03 | p | 1.0E-03 | p | 9.7E-03 | r | 2.0E-05 | p | y | 88-73-3 | o-Chloronitrobenzene | 1.4E+00 | nc** | 4.5E+00 | nc** | 7.3E-02 | nc** | 1.5E-01 | nc** | | |
| 6.7E-03 | p | 1.0E-03 | p | 6.7E-03 | r | 1.7E-04 | p | y | 100-00-5 | p-Chloronitrobenzene | 1.0E+01 | nc** | 3.7E+01 | nc** | 6.2E-01 | nc** | 1.2E+00 | nc** | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | y | 95-57-8 | 2-Chlorophenol | 6.3E+01 | nc | 2.4E+02 | nc | 1.8E+01 | nc | 3.0E+01 | nc | 4.0E+00 | 2.0E-01 |
| | | 2.9E-02 | r | | | 2.9E-02 | h | y | 75-29-6 | 2-Chloropropane | 1.7E+02 | nc | 5.9E+02 | nc | 1.0E+02 | nc | 1.7E+02 | nc | | |
| 1.1E-02 | h | 1.5E-02 | i | 1.1E-02 | r | 1.5E-02 | r | 0.1 | 1897-45-6 | Chlorothalonil | 4.4E+01 | ca* | 1.6E+02 | ca* | 6.1E-01 | ca* | 6.1E+00 | ca* | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | y | 95-49-8 | o-Chlorotoluene | 1.6E+02 | nc | 5.6E+02 | nc | 7.3E+01 | nc | 1.2E+02 | nc | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r | 0.1 | 101-21-3 | Chlorpropham | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C / skin abs. soils | CAS No. | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0.1 | 2921-88-2 | Chlorpyrifos | 1.8E+02 | nc | 1.8E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 1.0E-02 | h | | | 1.0E-02 | r | 0.1 | 5598-13-0 | Chlorpyrifos-methyl | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 64902-72-3 | Chlorsulfuron | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 8.0E-04 | h | | | 8.0E-04 | r | 0.1 | 60238-56-4 | Chlorthiophos | 4.9E+01 | nc | 4.9E+02 | nc | 2.9E+00 | nc | 2.9E+01 | nc | | |
| | | | | 4.2E+01 | i | | | | | Total Chromium (1:6 ratio Cr VI:Cr III)+++ | 2.1E+02 | ca | 4.5E+02 | ca | 1.6E-04 | ca | | | 3.8E+01 | 2.0E+00 |
| | | 1.5E+00 | i | | | | | | 16065-83-1 | Chromium III | 1.0E+05 | max | 1.0E+05 | max | | | 5.5E+04 | nc | | |
| | | 3.0E-03 | i | 2.9E+02 | i | 2.2E-06 | i | | 18540-29-9 | Chromium VI+++ | 3.0E+01 | ca** | 6.4E+01 | ca | 2.3E-05 | ca | 1.1E+02 | nc | 3.8E+01 | 2.0E+00 |
| | | 2.0E-02 | p | 9.8E+00 | p | 5.7E-06 | p | | 7440-48-4 | Cobalt | 9.0E+02 | ca** | 1.9E+03 | ca* | 6.9E-04 | ca* | 7.3E+02 | nc | | |
| | | | | 2.2E+00 | i | | | | 8007-45-2 | Coke Oven Emissions | | | | | 3.1E-03 | ca | | | | |
| | | 4.0E-02 | h | | | | | | 7440-50-8 | Copper and compounds | 3.1E+03 | nc | 4.1E+04 | nc | | | 1.5E+03 | nc | | |
| 1.9E+00 | h | | | 1.9E+00 | r | | | y | 123-73-9 | Crotonaldehyde | 5.3E-03 | ca | 1.1E-02 | ca | 3.5E-03 | ca | 5.9E-03 | ca | | |
| | | 1.0E-01 | i | | | 1.1E-01 | i | y | 98-82-8 | Cumene (isopropylbenzene) | 5.7E+02 | nc | 2.0E+03 | nc | 4.0E+02 | nc | 6.6E+02 | nc | | |
| 8.4E-01 | h | 2.0E-03 | h | 8.4E-01 | r | 2.0E-03 | r | 0.1 | 21725-46-2 | Cyanazine | 5.8E-01 | ca | 2.1E+00 | ca | 8.0E-03 | ca | 8.0E-02 | ca | | |
| | | 2.0E-02 | i | | | | | 0.1 | 57-12-5 | Cyanide (free) | 1.2E+03 | nc | 1.2E+04 | nc | | | 7.3E+02 | nc | | |
| | | 2.0E-02 | i | | | 8.6E-04 | i | y | 74-90-8 | Cyanide (hydrogen) | 1.1E+01 | nc | 3.5E+01 | nc | 3.1E+00 | nc | 6.2E+00 | nc | | |
| | | 4.0E-02 | i | | | 4.0E-02 | r | y | 460-19-5 | Cyanogen | 1.3E+02 | nc | 4.3E+02 | nc | 1.5E+02 | nc | 2.4E+02 | nc | | |
| | | 9.0E-02 | i | | | 9.0E-02 | r | y | 506-68-3 | Cyanogen bromide | 2.9E+02 | nc | 9.7E+02 | nc | 3.3E+02 | nc | 5.5E+02 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | y | 506-77-4 | Cyanogen chloride | 1.6E+02 | nc | 5.4E+02 | nc | 1.8E+02 | nc | 3.0E+02 | nc | | |
| | | 1.7E+00 | r | | | 1.7E+00 | i | y | 110-82-7 | **Cyclohexane** | 1.4E+02 | sat | 1.4E+02 | sat | 6.2E+03 | nc | 1.0E+04 | nc | | |
| | | 5.0E+00 | i | | | 5.0E+00 | r | 0.1 | 108-94-1 | Cyclohexanone | 1.0E+05 | max | 1.0E+05 | max | 1.8E+04 | nc | 1.8E+05 | nc | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r | 0.1 | 108-91-8 | Cyclohexylamine | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0.1 | 68085-85-8 | Cyhalothrin/Karate | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 52315-07-8 | Cypermethrin | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 7.5E-03 | i | | | 7.5E-03 | r | 0.1 | 66215-27-8 | Cyromazine | 4.6E+02 | nc | 4.6E+03 | nc | 2.7E+01 | nc | 2.7E+02 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 1861-32-1 | Dacthal | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0.1 | 75-99-0 | Dalapon | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0.1 | 39515-41-8 | Danitol | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| 2.4E-01 | i | | | 2.4E-01 | r | | | 0.03 | 72-54-8 | DDD | 2.4E+00 | ca | 1.0E+01 | ca | 2.8E-02 | ca | 2.8E-01 | ca | 1.6E+01 | 8.0E-01 |
| 3.4E-01 | i | | | 3.4E-01 | r | | | 0.03 | 72-55-9 | DDE | 1.7E+00 | ca | 7.0E+00 | ca | 2.0E-02 | ca | 2.0E-01 | ca | 5.4E+01 | 3.0E+00 |
| 3.4E-01 | i | 5.0E-04 | i | 3.4E-01 | i | 5.0E-04 | r | 0.03 | 50-29-3 | DDT | 1.7E+00 | ca* | 7.0E+00 | ca* | 2.0E-02 | ca* | 2.0E-01 | ca* | 3.2E+01 | 2.0E+00 |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 1163-19-5 | Decabromodiphenyl ether | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 4.0E-05 | i | | | 4.0E-05 | r | 0.1 | 8065-48-3 | Demeton | 2.4E+00 | nc | 2.5E+01 | nc | 1.5E-01 | nc | 1.5E+00 | nc | | |
| 6.1E-02 | h | | | 6.1E-02 | r | | | 0.1 | 2303-16-4 | Diallate | 8.0E+00 | ca | 2.8E+01 | ca | 1.1E-01 | ca | 1.1E+00 | ca | | |
| | | 9.0E-04 | h | | | 9.0E-04 | r | 0.1 | 333-41-5 | Diazinon | 5.5E+01 | nc | 5.5E+02 | nc | 3.3E+00 | nc | 3.3E+01 | nc | | |
| | | 2.0E-03 | n | | | 2.0E-03 | r | y | 132-64-9 | **Dibenzofuran** | 1.5E+02 | nc | 1.6E+03 | nc | 7.3E+00 | nc | 1.2E+01 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 106-37-6 | 1,4-Dibromobenzene | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| 8.4E-02 | i | 2.0E-02 | i | 8.4E-02 | r | 2.0E-02 | r | y | 124-48-1 | Dibromochloromethane | 1.1E+00 | ca | 2.6E+00 | ca | 8.0E-02 | ca | 1.3E-01 | ca | 4.0E-01 | 2.0E-02 |
| 1.4E+00 | h | 5.7E-05 | r | 2.4E-03 | x | 5.7E-05 | i | y | 96-12-8 | **1,2-Dibromo-3-chloropropane (DBCP)** | 4.6E-01 | ca** | 2.0E+00 | ca** | 2.1E-01 | nc | 4.8E-02 | ca** | | |
| 7.0E+00 | c | | | 7.0E+00 | c | | | y | 96-12-8 | **"CAL-Modified PRG"** | 3.0E-02 | ca | 7.6E-02 | ca | 9.6E-04 | ca | 1.6E-03 | ca | | |
| 2.0E+00 | i | 9.0E-03 | i | 2.0E+00 | i | 2.6E-03 | i | y | 106-93-4 | **1,2-Dibromoethane (EDB)** | 3.2E-02 | ca | 7.3E-02 | ca | 3.4E-03 | ca | 5.6E-03 | ca | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0.1 | 84-74-2 | Dibutyl phthalate | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | 2.3E+03 | 2.7E+02 |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0.1 | 1918-00-9 | Dicamba | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG) ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C / skin abs. soils / CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 9.0E-02 | i | | | 5.7E-02 | h | y | 95-50-1 | **1,2-Dichlorobenzene** | 6.0E+02 | sat | 6.0E+02 | sat | 2.1E+02 | nc | 3.7E+02 | nc | 1.7E+01 | 9.0E-01 |
| | | 3.0E-02 | n | | | 3.0E-02 | r | y | 541-73-1 | **1,3-Dichlorobenzene** | 5.3E+02 | nc | 6.0E+02 | sat | 1.1E+02 | nc | 1.8E+02 | nc | | |
| 2.4E-02 | h | 3.0E-02 | n | 2.2E-02 | n | 2.3E-01 | i | y | 106-46-7 | 1,4-Dichlorobenzene | 3.4E+00 | ca | 7.9E+00 | ca | 3.1E-01 | ca | 5.0E-01 | ca | 2.0E+00 | 1.0E-01 |
| 4.5E-01 | i | | | 4.5E-01 | r | | | 0.1 | 91-94-1 | 3,3-Dichlorobenzidine | 1.1E+00 | ca | 3.8E+00 | ca | 1.5E-02 | ca | 1.5E-01 | ca | 7.0E-03 | 3.0E-04 |
| | | 3.0E-02 | n | | | 3.0E-02 | r | 0.1 | 90-98-2 | 4,4'-Dichlorobenzophenone | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| 9.3E+00 | r | | | 9.3E+00 | h | | | y | 764-41-0 | 1,4-Dichloro-2-butene | 7.9E-03 | ca | 1.8E-02 | ca | 7.2E-04 | ca | 1.2E-03 | ca | | |
| | | 2.0E-01 | i | | | 5.7E-02 | h | y | 75-71-8 | Dichlorodifluoromethane | 9.4E+01 | nc | 3.1E+02 | nc | 2.1E+02 | nc | 3.9E+02 | nc | | |
| | | 1.0E-01 | h | | | 1.4E-01 | h | y | 75-34-3 | 1,1-Dichloroethane | 5.1E+02 | nc | 1.7E+03 | nc | 5.2E+02 | nc | 8.1E+02 | nc | 2.3E+01 | 1.0E+00 |
| 5.7E-03 | c | | | 5.7E-03 | c | | | y | | "CAL-Modified PRG" | 2.8E+00 | ca | 6.0E+00 | ca | 1.2E+00 | ca | 2.0E+00 | ca | | |
| 9.1E-02 | i | 2.0E-02 | n | 9.1E-02 | i | 1.4E-03 | n | y | 107-06-2 | 1,2-Dichloroethane (EDC) | 2.8E-01 | ca* | 6.0E-01 | ca* | 7.4E-02 | ca* | 1.2E-01 | ca* | 2.0E-02 | 1.0E-03 |
| | | 5.0E-02 | i | | | 5.7E-02 | i | y | 75-35-4 | 1,1-Dichloroethylene | 1.2E+02 | nc | 4.1E+02 | nc | 2.1E+02 | nc | 3.4E+02 | nc | 6.0E-02 | 3.0E-03 |
| | | 1.0E-02 | p | | | 1.0E-02 | r | y | 156-59-2 | 1,2-Dichloroethylene (cis) | 4.3E+01 | nc | 1.5E+02 | nc | 3.7E+01 | nc | 6.1E+01 | nc | 4.0E-01 | 2.0E-02 |
| | | 2.0E-02 | i | | | 2.0E-02 | r | y | 156-60-5 | 1,2-Dichloroethylene (trans) | 6.9E+01 | nc | 2.3E+02 | nc | 7.3E+01 | nc | 1.2E+02 | nc | 7.0E-01 | 3.0E-02 |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0.1 | 120-83-2 | 2,4-Dichlorophenol | 1.8E+02 | nc | 1.8E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | 1.0E+00 | 5.0E-02 |
| | | 8.0E-03 | i | | | 8.0E-03 | r | 0.1 | 94-82-6 | 4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB) | 4.9E+02 | nc | 4.9E+03 | nc | 2.9E+01 | nc | 2.9E+02 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.05 | 94-75-7 | 2,4-Dichlorophenoxyacetic Acid (2,4-D) | 6.9E+02 | nc | 7.7E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| 6.8E-02 | h | 1.1E-03 | r | 6.8E-02 | r | 1.1E-03 | i | y | 78-87-5 | 1,2-Dichloropropane | 3.4E-01 | ca* | 7.4E-01 | ca* | 9.9E-02 | ca* | 1.6E-01 | ca* | 3.0E-02 | 1.0E-03 |
| | | 2.0E-02 | p | | | 2.0E-02 | r | y | 142-28-9 | **1,3-Dichloropropane** | 1.0E+02 | nc | 3.6E+02 | nc | 7.3E+01 | nc | 1.2E+02 | nc | | |
| 1.0E-01 | i | 3.0E-02 | i | 1.4E-02 | i | 5.7E-03 | i | y | 542-75-6 | 1,3-Dichloropropene | 7.8E-01 | ca | 1.8E+00 | ca | 4.8E-01 | ca | 4.0E-01 | ca | 4.0E-03 | 2.0E-04 |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0.1 | 616-23-9 | 2,3-Dichloropropanol | 1.8E+02 | nc | 1.8E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| 2.9E-01 | i | 5.0E-04 | i | 2.9E-01 | r | 1.4E-04 | i | 0.1 | 62-73-7 | Dichlorvos | 1.7E+00 | ca* | 5.9E+00 | ca* | 2.3E-02 | ca* | 2.3E-01 | ca* | | |
| 4.4E-01 | x | | | 4.4E-01 | r | | | 0.1 | 115-32-2 | Dicofol | 1.1E+00 | ca | 3.9E+00 | ca | 1.5E-02 | ca | 1.5E-01 | ca | | |
| | | 3.0E-02 | h | | | 5.7E-05 | x | y | 77-73-6 | Dicyclopentadiene | 5.4E-01 | nc | 1.8E+00 | nc | 2.1E-01 | nc | 4.2E-01 | nc | | |
| 1.6E+01 | i | 5.0E-05 | i | 1.6E+01 | i | 5.0E-05 | r | 0.1 | 60-57-1 | Dieldrin | 3.0E-02 | ca | 1.1E-01 | ca | 4.2E-04 | ca | 4.2E-03 | ca | 4.0E-03 | 2.0E-04 |
| | | 1.0E-02 | p | | | 5.7E-03 | p | 0.1 | 112-34-5 | Diethylene glycol, monobutyl ether | 6.1E+02 | nc | 6.2E+03 | nc | 2.1E+01 | nc | 3.6E+02 | nc | | |
| | | 6.0E-02 | p | | | 8.6E-04 | p | 0.1 | 111-90-0 | Diethylene glycol, monoethyl ether | 3.7E+03 | nc | 3.7E+04 | nc | 3.1E+00 | nc | 2.2E+03 | nc | | |
| | | 4.0E-04 | p | | | 4.0E-04 | r | 0.1 | 617-84-5 | Diethylformamide | 2.4E+01 | nc | 2.5E+02 | nc | 1.5E+00 | nc | 1.5E+01 | nc | | |
| 1.2E-03 | i | 6.0E-01 | i | 1.2E-03 | r | 6.0E-01 | r | 0.1 | 103-23-1 | Di(2-ethylhexyl)adipate | 4.1E+02 | ca | 1.4E+03 | ca | 5.6E+00 | ca | 5.6E+01 | ca | | |
| | | 8.0E-01 | i | | | 8.0E-01 | r | 0.1 | 84-66-2 | Diethyl phthalate | 4.9E+04 | nc | 1.0E+05 | max | 2.9E+03 | nc | 2.9E+04 | nc | | |
| 4.7E+03 | h | | | 4.7E+03 | r | | | 0.1 | 56-53-1 | Diethylstilbestrol | 1.0E-04 | ca | 3.7E-04 | ca | 1.4E-06 | ca | 1.4E-05 | ca | | |
| | | 8.0E-02 | i | | | 8.0E-02 | r | 0.1 | 43222-48-6 | Difenzoquat (Avenge) | 4.9E+03 | nc | 4.9E+04 | nc | 2.9E+02 | nc | 2.9E+03 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 35367-38-5 | Diflubenzuron | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.1E+01 | r | | | 1.1E+01 | i | y | 75-37-6 | 1,1-Difluoroethane | | | | | 4.2E+04 | nc | 6.9E+04 | nc | | |
| | | 2.0E-02 | n | | | 2.0E-02 | r | 0.1 | 28553-12-0 | Diisononyl phthalate | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | | | | | 1.1E-01 | p | | 108-20-3 | **Diisopropyl ether** | | | | | 4.0E+02 | nc | | | | |
| | | 8.0E-02 | i | | | 8.0E-02 | r | 0.1 | 1445-75-6 | Diisopropyl methylphosphonate | 4.9E+03 | nc | 4.9E+04 | nc | 2.9E+02 | nc | 2.9E+03 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 55290-64-7 | Dimethipin | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-04 | i | | | 2.0E-04 | r | 0.1 | 60-51-5 | Dimethoate | 1.2E+01 | nc | 1.2E+02 | nc | 7.3E-01 | nc | 7.3E+00 | nc | | |
| 1.4E-02 | h | | | 1.4E-02 | r | | | 0.1 | 119-90-4 | 3,3'-Dimethoxybenzidine | 3.5E+01 | ca | 1.2E+02 | ca | 4.8E-01 | ca | 4.8E+00 | ca | | |
| | | 5.7E-06 | r | | | 5.7E-06 | x | y | 124-40-3 | Dimethylamine | 6.7E-02 | nc | 2.5E-01 | nc | 2.1E-02 | nc | 3.5E-02 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0.1 | 121-69-7 | N-N-Dimethylaniline | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| 7.5E-01 | h | | | 7.5E-01 | r | | | 0.1 | 95-68-1 | 2,4-Dimethylaniline | 6.5E-01 | ca | 2.3E+00 | ca | 9.0E-03 | ca | 9.0E-02 | ca | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | V O C / skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| 5.8E-01 | h | | | 5.8E-01 | r | | 0.1 | 21436-96-4 | 2,4-Dimethylaniline hydrochloride | 8.4E-01 | ca | 3.0E+00 | ca | 1.2E-02 | ca | 1.2E-01 | ca | | |
| 2.3E+00 | p | | | 2.3E+00 | r | | 0.1 | 119-93-7 | **3,3'-Dimethylbenzidine** | 2.1E-01 | ca | 7.5E-01 | ca | 2.9E-03 | ca | 2.9E-02 | ca | | |
| | | 1.0E-01 | h | | | 8.6E-03 | i 0.1 | 68-12-2 | N,N-Dimethylformamide | 6.1E+03 | nc | 6.2E+04 | nc | 3.1E+01 | nc | 3.6E+03 | nc | | |
| | | 1.0E-03 | n | | | 1.0E-03 | r 0.1 | 122-09-8 | Dimethylphenethylamine | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r 0.1 | 105-67-9 | 2,4-Dimethylphenol | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | 9.0E+00 | 4.0E-01 |
| | | 6.0E-04 | i | | | 6.0E-04 | r 0.1 | 576-26-1 | 2,6-Dimethylphenol | 3.7E+01 | nc | 3.7E+02 | nc | 2.2E+00 | nc | 2.2E+01 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r 0.1 | 95-65-8 | 3,4-Dimethylphenol | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 1.0E+01 | h | | | 1.0E+01 | r 0.1 | 131-11-3 | Dimethyl phthalate | 1.0E+05 | max | 1.0E+05 | max | 3.7E+04 | nc | 3.6E+05 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r 0.1 | 120-61-6 | Dimethyl terephthalate | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 1.0E-04 | p | | | 1.0E-04 | r 0.1 | 534-52-1 | **4,6-Dinitro-o-cresol** | 6.1E+00 | nc | 6.2E+01 | nc | 3.7E-01 | nc | 3.6E+00 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r 0.1 | 131-89-5 | 4,6-Dinitro-o-cyclohexyl phenol | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 1.0E-04 | p | | | 1.0E-04 | r 0.1 | 528-29-0 | 1,2-Dinitrobenzene | 6.1E+00 | nc | 6.2E+01 | nc | 3.7E-01 | nc | 3.6E+00 | nc | | |
| | | 1.0E-04 | i | | | 1.0E-04 | r 0.1 | 99-65-0 | 1,3-Dinitrobenzene | 6.1E+00 | nc | 6.2E+01 | nc | 3.7E-01 | nc | 3.6E+00 | nc | | |
| | | 1.0E-04 | p | | | 1.0E-04 | r 0.1 | 100-25-4 | 1,4-Dinitrobenzene | 6.1E+00 | nc | 6.2E+01 | nc | 3.7E-01 | nc | 3.6E+00 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r 0.1 | 51-28-5 | 2,4-Dinitrophenol | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | 3.0E-01 | 1.0E-02 |
| 6.8E-01 | i | | | 6.8E-01 | r | | 0.1 | 25321-14-6 | Dinitrotoluene mixture | 7.2E-01 | ca | 2.5E+00 | ca | 9.9E-03 | ca | 9.9E-02 | ca | 8.0E-04 | 4.0E-05 |
| | | 2.0E-03 | i | | | 2.0E-03 | r 0.1 | 121-14-2 | 2,4-Dinitrotoluene (also see Dinitrotoluene mixture) | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | 8.0E-04 | 4.0E-05 |
| | | 1.0E-03 | h | | | 1.0E-03 | r 0.1 | 606-20-2 | 2,6-Dinitrotoluene (also see Dinitrotoluene mixture) | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | 7.0E-04 | 3.0E-05 |
| | | 1.0E-03 | i | | | 1.0E-03 | r 0.1 | 88-85-7 | Dinoseb | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 4.0E-02 | p | | | 4.0E-02 | r 0.1 | 117-84-0 | di-n-Octyl phthalate | 2.4E+03 | nc | 2.5E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | 1.0E+04 | 1.0E+04 |
| 1.1E-02 | i | | | 1.1E-02 | r | | 0.1 | 123-91-1 | 1,4-Dioxane | 4.4E+01 | ca | 1.6E+02 | ca | 6.1E-01 | ca | 6.1E+00 | ca | | |
| 1.5E+05 | h | | | 1.5E+05 | h | | 0.03 | 1746-01-6 | Dioxin (2,3,7,8-TCDD)+++ | 3.9E-06 | ca | 1.6E-05 | ca | 4.5E-08 | ca | 4.5E-07 | ca | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r 0.1 | 957-51-7 | Diphenamid | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r 0.1 | 122-39-4 | Diphenylamine | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 3.0E-04 | p | | | 3.0E-04 | r 0.1 | 74-31-7 | N,N-Diphenyl-1,4 benzenediamine (DPPD) | 1.8E+01 | nc | 1.8E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| 8.0E-01 | i | | | 8.0E-01 | i | | 0.1 | 122-66-7 | 1,2-Diphenylhydrazine | 6.1E-01 | ca | 2.2E+00 | ca | 8.4E-03 | ca | 8.4E-02 | ca | | |
| | | 3.0E-03 | p | | | 3.0E-03 | r 0.1 | 127-63-9 | Diphenyl sulfone | 1.8E+02 | nc | 1.8E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 2.2E-03 | i | | | 2.2E-03 | r 0.1 | 85-00-7 | Diquat | 1.3E+02 | nc | 1.4E+03 | nc | 8.0E+00 | nc | 8.0E+01 | nc | | |
| 8.6E+00 | h | | | 8.6E+00 | r | | 0.1 | 1937-37-7 | Direct black 38 | 5.7E-02 | ca | 2.0E-01 | ca | 7.8E-04 | ca | 7.8E-03 | ca | | |
| 8.1E+00 | h | | | 8.1E+00 | r | | 0.1 | 2602-46-2 | Direct blue 6 | 6.0E-02 | ca | 2.1E-01 | ca | 8.3E-04 | ca | 8.3E-03 | ca | | |
| 9.3E+00 | h | | | 9.3E+00 | r | | 0.1 | 16071-86-6 | Direct brown 95 | 5.2E-02 | ca | 1.9E-01 | ca | 7.2E-04 | ca | 7.2E-03 | ca | | |
| | | 4.0E-05 | i | | | 4.0E-05 | r 0.1 | 298-04-4 | Disulfoton | 2.4E+00 | nc | 2.5E+01 | nc | 1.5E-01 | nc | 1.5E+00 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r 0.1 | 505-29-3 | 1,4-Dithiane | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r 0.1 | 330-54-1 | Diuron | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 4.0E-03 | i | | | 4.0E-03 | r 0.1 | 2439-10-3 | Dodine | 2.4E+02 | nc | 2.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | | |
| | | 1.0E-01 | n | | | | | 7429-91-6 | Dysprosium | 7.8E+03 | nc | 1.0E+05 | max | | | 3.6E+03 | nc | | |
| | | 6.0E-03 | i | | | 6.0E-03 | r 0.1 | 115-29-7 | Endosulfan | 3.7E+02 | nc | 3.7E+03 | nc | 2.2E+01 | nc | 2.2E+02 | nc | 1.8E+01 | 9.0E-01 |
| | | 2.0E-02 | i | | | 2.0E-02 | r 0.1 | 145-73-3 | Endothall | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 3.0E-04 | i | | | 3.0E-04 | r 0.1 | 72-20-8 | Endrin | 1.8E+01 | nc | 1.8E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | 1.0E+00 | 5.0E-02 |
| 9.9E-03 | i | 2.0E-03 | h | 4.2E-03 | h | 2.9E-04 | i y | 106-89-8 | Epichlorohydrin | 7.6E+00 | nc | 2.6E+01 | nc | 1.0E+00 | nc | 2.0E+00 | nc | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | V O C / skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| 8.00E-02 | r | | | 8.00E-02 | c | | y | | **"CAL-Modified PRG"** | 1.3E+00 | nc | 2.9E+00 | nc | 8.4E-02 | nc | 1.4E-01 | nc | | |
| | | 5.7E-03 | r | | | 5.7E-03 | i 0.1 | 106-88-7 | 1,2-Epoxybutane | 3.5E+02 | nc | 3.5E+03 | nc | 2.1E+01 | nc | 2.1E+02 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r 0.1 | 759-94-4 | EPTC (S-Ethyl dipropylthiocarbamate) | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r 0.1 | 16672-87-0 | Ethephon (2-chloroethyl phosphonic acid) | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 5.0E-04 | i | | | 5.0E-04 | r 0.1 | 563-12-2 | Ethion | 3.1E+01 | nc | 3.1E+02 | nc | 1.8E+00 | nc | 1.8E+01 | nc | | |
| | | 4.0E-01 | h | | | 5.7E-02 | i 0.1 | 110-80-5 | 2-Ethoxyethanol | 2.4E+04 | nc | 1.0E+05 | max | 2.1E+02 | nc | 1.5E+04 | nc | | |
| | | 3.0E-01 | h | | | 3.0E-01 | r 0.1 | 111-15-9 | 2-Ethoxyethanol acetate | 1.8E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.1E+04 | nc | | |
| | | 9.0E-01 | i | | | 9.0E-01 | r y | 141-78-6 | Ethyl acetate | 1.9E+04 | nc | 3.7E+04 | sat | 3.3E+03 | nc | 5.5E+03 | nc | | |
| 4.8E-02 | h | | | 4.8E-02 | r | | y | 140-88-5 | Ethyl acrylate | 2.1E-01 | ca | 4.5E-01 | ca | 1.4E-01 | ca | 2.3E-01 | ca | | |
| | | 1.0E-01 | i | | | 2.9E-01 | i y | 100-41-4 | **Ethylbenzene** | 4.0E+02 | sat | 4.0E+02 | sat | 1.1E+03 | nc | 1.3E+03 | nc | 1.3E+01 | 7.0E-01 |
| 2.9E-03 | n | 4.0E-01 | n | 2.9E-03 | r | 2.9E+00 | i y | 75-00-3 | Ethyl chloride | 3.0E+00 | ca | 6.5E+00 | ca | 2.3E+00 | ca | 4.6E+00 | ca | | |
| | | 3.0E-01 | h | | | 3.0E-01 | r 0.1 | 109-78-4 | Ethylene cyanohydrin | 1.8E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.1E+04 | nc | | |
| | | 9.0E-02 | p | | | 9.0E-02 | r 0.1 | 107-15-3 | **Ethylene diamine** | 5.5E+03 | nc | 5.5E+04 | nc | 3.3E+02 | nc | 3.3E+03 | nc | | |
| | | 2.0E+00 | i | | | 2.0E+00 | r 0.1 | 107-21-1 | Ethylene glycol | 1.0E+05 | max | 1.0E+05 | max | 7.3E+03 | nc | 7.3E+04 | nc | | |
| | | 5.0E-01 | i | | | 3.7E+00 | i 0.1 | 111-76-2 | Ethylene glycol, monobutyl ether | 3.1E+04 | nc | 1.0E+05 | max | 1.4E+04 | nc | 1.8E+04 | nc | | |
| 1.0E+00 | h | | | 3.5E-01 | h | | y | 75-21-8 | Ethylene oxide | 1.4E-01 | ca | 3.4E-01 | ca | 1.9E-02 | ca | 2.4E-02 | ca | | |
| 1.1E-01 | h | 8.0E-05 | i | 1.1E-01 | r | 8.0E-05 | r 0.1 | 96-45-7 | Ethylene thiourea (ETU) | 4.4E+00 | ca** | 1.6E+01 | ca** | 6.1E-02 | ca** | 6.1E-01 | ca** | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r y | 60-29-7 | Ethyl ether | 1.8E+03 | sat | 1.8E+03 | sat | 7.3E+02 | nc | 1.2E+03 | nc | | |
| | | 9.0E-02 | h | | | 9.0E-02 | r y | 97-63-2 | Ethyl methacrylate | 1.4E+02 | sat | 1.4E+02 | sat | 3.3E+02 | nc | 5.5E+02 | nc | | |
| | | 1.0E-05 | i | | | 1.0E-05 | r 0.1 | 2104-64-5 | Ethyl p-nitrophenyl phenylphosphorothioate | 6.1E-01 | nc | 6.2E+00 | nc | 3.7E-02 | nc | 3.6E-01 | nc | | |
| | | 3.0E+00 | i | | | 3.0E+00 | r 0.1 | 84-72-0 | Ethylphthalyl ethyl glycolate | 1.0E+05 | max | 1.0E+05 | max | 1.1E+04 | nc | 1.1E+05 | nc | | |
| | | 8.0E-03 | i | | | 8.0E-03 | r 0.1 | 101200-48-0 | Express | 4.9E+02 | nc | 4.9E+03 | nc | 2.9E+01 | nc | 2.9E+02 | nc | | |
| | | 2.5E-04 | i | | | 2.5E-04 | r 0.1 | 22224-92-6 | Fenamiphos | 1.5E+01 | nc | 1.5E+02 | nc | 9.1E-01 | nc | 9.1E+00 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r 0.1 | 2164-17-2 | Fluometuron | 7.9E+02 | nc | 8.0E+03 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 6.0E-02 | i | | | | 0.1 | 16984-48-8 | Fluorine (soluble fluoride) | 3.7E+03 | nc | 3.7E+04 | nc | | | 2.2E+03 | nc | | |
| | | 8.0E-02 | i | | | 8.0E-02 | r 0.1 | 59756-60-4 | Fluoridone | 4.9E+03 | nc | 4.9E+04 | nc | 2.9E+02 | nc | 2.9E+03 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r 0.1 | 56425-91-3 | Flurprimidol | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 6.0E-02 | i | | | 6.0E-02 | r 0.1 | 66332-96-5 | Flutolanil | 3.7E+03 | nc | 3.7E+04 | nc | 2.2E+02 | nc | 2.2E+03 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r 0.1 | 69409-94-5 | Fluvalinate | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| 3.5E-03 | i | 1.0E-01 | i | 3.5E-03 | r | 1.0E-01 | r 0.1 | 133-07-3 | Folpet | 1.4E+02 | ca* | 4.9E+02 | ca | 1.9E+00 | ca | 1.9E+01 | ca | | |
| 1.9E-01 | i | | | 1.9E-01 | r | | 0.1 | 72178-02-0 | Fomesafen | 2.6E+00 | ca | 9.1E+00 | ca | 3.5E-02 | ca | 3.5E-01 | ca | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r 0.1 | 944-22-9 | Fonofos | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 1.5E-01 | i | 4.6E-02 | i | | 0.1 | 50-00-0 | Formaldehyde | 9.2E+03 | nc | 1.0E+05 | nc | 1.5E-01 | ca | 5.5E+03 | nc | | |
| | | 2.0E+00 | h | | | 8.6E-04 | p 0.1 | 64-18-6 | **Formic Acid** | 1.0E+05 | max | 1.0E+05 | max | 3.1E+00 | nc | 7.3E+04 | nc | | |
| | | 3.0E+00 | i | | | 3.0E+00 | r 0.1 | 39148-24-8 | Fosetyl-al | 1.0E+05 | max | 1.0E+05 | max | 1.1E+04 | nc | 1.1E+05 | nc | | |
| | | 3.0E+01 | i | | | 8.6E+00 | h y | 76-13-1 | Freon 113 | 5.6E+03 | sat | 5.6E+03 | sat | 3.1E+04 | nc | 5.9E+04 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r y | 110-00-9 | Furan | 2.5E+00 | nc | 8.5E+00 | nc | 3.7E+00 | nc | 6.1E+00 | nc | | |
| 3.8E+00 | h | | | 3.8E+00 | r | | 0.1 | 67-45-8 | Furazolidone | 1.3E-01 | ca | 4.5E-01 | ca | 1.8E-03 | ca | 1.8E-02 | ca | | |
| | | 3.0E-03 | i | | | 1.4E-02 | h 0.1 | 98-01-1 | Furfural | 1.8E+02 | nc | 1.8E+03 | nc | 5.2E+01 | nc | 1.1E+02 | nc | | |
| 5.0E+01 | h | | | 5.0E+01 | r | | 0.1 | 531-82-8 | Furium | 9.7E-03 | ca | 3.4E-02 | ca | 1.3E-04 | ca | 1.3E-03 | ca | | |
| 3.0E-02 | i | | | 3.0E-02 | r | | 0.1 | 60568-05-0 | Furmecyclox | 1.6E+01 | ca | 5.7E+01 | ca | 2.2E-01 | ca | 2.2E+00 | ca | | |
| | | 4.0E-04 | i | | | 4.0E-04 | r 0.1 | 77182-82-2 | Glufosinate-ammonium | 2.4E+01 | nc | 2.5E+02 | nc | 1.5E+00 | nc | 1.5E+01 | nc | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG) ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | | | | | | | | | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 4.0E-04 | i | | | 2.9E-04 | h | Glycidaldehyde | 2.4E+01 | nc | 2.5E+02 | nc | 1.0E+00 | nc | 1.5E+01 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | Glyphosate | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 5.0E-05 | i | | | 5.0E-05 | r | Haloxyfop-methyl | 3.1E+00 | nc | 3.1E+01 | nc | 1.8E-01 | nc | 1.8E+00 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | Harmony | 7.9E+02 | nc | 8.0E+03 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| 4.5E+00 | i | 5.0E-04 | i | 4.6E+00 | i | 5.0E-04 | r | Heptachlor | 1.1E-01 | ca | 3.8E-01 | ca | 1.5E-03 | ca | 1.5E-02 | ca | 2.3E+01 | 1.0E+00 |
| 9.1E+00 | i | 1.3E-05 | i | 9.1E+00 | i | 1.3E-05 | r | Heptachlor epoxide | 5.3E-02 | ca* | 1.9E-01 | ca* | 7.4E-04 | ca* | 7.4E-03 | ca* | 7.0E-01 | 3.0E-02 |
| | | 2.0E-03 | i | | | 2.0E-03 | r | Hexabromobenzene | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| 1.6E+00 | i | 8.0E-04 | i | 1.6E+00 | i | 8.0E-04 | r | Hexachlorobenzene | 3.0E-01 | ca | 1.1E+00 | ca | 4.2E-03 | ca | 4.2E-02 | ca | 2.0E+00 | 1.0E-01 |
| 7.8E-02 | i | 3.0E-04 | n | 7.8E-02 | i | 3.0E-04 | r | Hexachlorobutadiene | 6.2E+00 | ca** | 2.2E+01 | ca** | 8.6E-02 | ca* | 8.6E-01 | ca* | 2.0E+00 | 1.0E-01 |
| 6.3E+00 | i | 5.0E-04 | n | 6.3E+00 | i | 5.0E-04 | r | HCH (alpha) | 9.0E-02 | ca | 3.6E-01 | ca | 1.1E-03 | ca | 1.1E-02 | ca | 5.0E-04 | 3.0E-05 |
| 1.8E+00 | i | 2.0E-04 | n | 1.8E+00 | i | 2.0E-04 | r | HCH (beta) | 3.2E-01 | ca | 1.3E+00 | ca | 3.7E-03 | ca | 3.7E-02 | ca | 3.0E-03 | 1.0E-04 |
| 1.3E+00 | h | 3.0E-04 | i | 1.3E+00 | r | 3.0E-04 | r | HCH (gamma) Lindane | 4.4E-01 | ca* | 1.7E+00 | ca | 5.2E-03 | ca | 5.2E-02 | ca | 9.0E-03 | 5.0E-04 |
| 1.8E+00 | i | | | 1.8E+00 | i | | | HCH-technical | 3.2E-01 | ca | 1.3E+00 | ca | 3.8E-03 | ca | 3.7E-02 | ca | 3.0E-03 | 1.0E-04 |
| | | 6.0E-03 | i | | | 5.7E-05 | i | Hexachlorocyclopentadiene | 3.7E+02 | nc | 3.7E+03 | nc | 2.1E-01 | nc | 2.2E+02 | nc | 4.0E+02 | 2.0E+01 |
| 1.4E-02 | i | 1.0E-03 | i | 1.4E-02 | i | 1.0E-03 | r | Hexachloroethane | 3.5E+01 | ca** | 1.2E+02 | ca** | 4.8E-01 | ca** | 4.8E+00 | ca** | 5.0E-01 | 2.0E-02 |
| | | 3.0E-04 | i | | | 3.0E-04 | r | Hexachlorophene | 1.8E+01 | nc | 1.8E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| 1.1E-01 | i | 3.0E-03 | i | 1.1E-01 | r | 3.0E-03 | r | Hexahydro-1,3,5-trinitro-1,3,5-triazine | 4.4E+00 | ca* | 1.6E+01 | ca | 6.1E-02 | ca | 6.1E-01 | ca | | |
| | | 2.9E-06 | r | | | 2.9E-06 | i | 1,6-Hexamethylene diisocyanate | 1.7E-01 | nc | 1.8E+00 | nc | 1.0E-02 | nc | 1.0E-01 | nc | | |
| | | 1.1E+01 | p | | | 5.7E-02 | i y | **n-Hexane** | 1.1E+02 | sat | 1.1E+02 | sat | 2.1E+02 | nc | 4.2E+02 | nc | | |
| | | 3.3E-02 | i | | | 3.3E-02 | r | Hexazinone | 2.0E+03 | nc | 2.0E+04 | nc | 1.2E+02 | nc | 1.2E+03 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | HMX | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| 3.0E+00 | i | | | 1.7E+01 | i | | | Hydrazine, hydrazine sulfate | 1.6E-01 | ca | 5.7E-01 | ca | 3.9E-04 | ca | 2.2E-02 | ca | | |
| 3.0E+00 | n | | | 1.7E+01 | n | | | Hydrazine, monomethyl | 1.6E-01 | ca | 5.7E-01 | ca | 4.0E-04 | ca | 2.2E-02 | ca | | |
| 3.0E+00 | n | | | 1.7E+01 | n | | | Hydrazine, dimethyl | 1.6E-01 | ca | 5.7E-01 | ca | 4.0E-04 | ca | 2.2E-02 | ca | | |
| | | | | | | 5.7E-03 | i | Hydrogen chloride | | | | | 2.1E+01 | nc | | | | |
| | | 2.0E-02 | i | | | 8.6E-04 | i y | Hydrogen cyanide | 1.1E+01 | nc | 3.5E+01 | nc | 3.1E+00 | nc | 6.2E+00 | nc | | |
| | | 3.0E-03 | i | | | 2.9E-04 | i | Hydrogen sulfide | | | | | 1.0E+00 | nc | 1.1E+02 | nc | | |
| 5.6E-02 | p | 4.0E-02 | p | 5.6E-02 | r | 4.0E-02 | r | **p-Hydroquinone** | 8.7E+00 | ca | 3.1E+01 | ca | 1.2E-01 | ca | 1.2E+00 | ca | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | Imazalil | 7.9E+02 | nc | 8.0E+03 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 2.5E-01 | i | | | 2.5E-01 | r | Imazaquin | 1.5E+04 | nc | 1.0E+05 | max | 9.1E+02 | nc | 9.1E+03 | nc | | |
| | | 4.0E-02 | i | | | 4.0E-02 | r | Iprodione | 2.4E+03 | nc | 2.5E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | | |
| | | 3.0E-01 | n | | | | | Iron | 2.3E+04 | nc | 1.0E+05 | max | | | 1.1E+04 | nc | | |
| | | 3.0E-01 | i | | | 3.0E-01 | r y | Isobutanol | 1.3E+04 | nc | 4.0E+04 | sat | 1.1E+03 | nc | 1.8E+03 | nc | | |
| 9.5E-04 | i | 2.0E-01 | i | 9.5E-04 | r | 2.0E-01 | r | Isophorone | 5.1E+02 | ca* | 5.1E+02 | ca* | 7.1E+00 | ca | 7.1E+01 | ca | 5.0E-01 | 3.0E-02 |
| | | 1.5E-02 | i | | | 1.5E-02 | r | Isopropalin | 9.2E+02 | nc | 9.2E+03 | nc | 5.5E+01 | nc | 5.5E+02 | nc | | |
| | | 1.0E-01 | i | | | 1.1E-01 | r | Isopropyl methyl phosphonic acid | 6.1E+03 | nc | 6.2E+04 | nc | 4.0E+02 | nc | 3.6E+03 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | Isoxaben | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| 8.0E+00 | p | 2.0E-04 | p | 8.0E+00 | r | 2.0E-04 | r | Kepone | 6.1E-02 | ca | 2.2E-01 | ca | 8.4E-04 | ca | 8.4E-03 | ca | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | Lactofen | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| www.epa.gov/superfund/programs/lead/ieubk.htm | | | | | | | | **Lead+++** | 4.0E+02 | nc | 8.0E+02 | nc | | | | | | |
| www.dtsc.ca.gov/ScienceTechnology/ledspred.html | | | | | | | | "CAL-Modified PRG"+++ | 1.5E+02 | nc | | | | | | | | |
| | | 1.0E-07 | i | | | | | Lead (tetraethyl) | 6.1E-03 | nc | 6.2E-02 | nc | | | 3.6E-03 | nc | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | V O C | skin abs. soils | CAS No. | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0.1 | 330-55-2 | Linuron | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 2.0E-02 | x | | | | | | 7439-93-2 | Lithium | 1.6E+03 | nc | 2.0E+04 | nc | | | 7.3E+02 | nc | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r | 0.1 | 83055-99-6 | Londax | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 121-75-5 | Malathion | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0.1 | 108-31-6 | Maleic anhydride | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 5.0E-01 | i | | | 5.0E-01 | r | y | 123-33-1 | Maleic hydrazide | 1.7E+03 | nc | 2.4E+03 | sat | 1.8E+03 | nc | 3.0E+03 | nc | | |
| | | 1.0E-04 | p | | | 1.0E-04 | r | 0.1 | 109-77-3 | **Malononitrile** | 6.1E+00 | nc | 6.2E+01 | nc | 3.7E-01 | nc | 3.6E+00 | nc | | |
| | | 3.0E-02 | h | | | 3.0E-02 | r | 0.1 | 8018-01-7 | Mancozeb | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| 6.0E-02 | o | 5.0E-03 | i | 6.0E-02 | r | 5.0E-03 | r | 0.1 | 12427-38-2 | Maneb | 8.1E+00 | ca* | 2.9E+01 | ca | 1.1E-01 | ca | 1.1E+00 | ca | | |
| | | 2.4E-02 | i | | | 1.4E-05 | i | | 7439-96-5 | Manganese and compounds+++ | 1.8E+03 | nc | 1.9E+04 | nc | 5.1E-02 | nc | 8.8E+02 | nc | | |
| | | 9.0E-05 | h | | | 9.0E-05 | r | 0.1 | 950-10-7 | Mephosfolan | 5.5E+00 | nc | 5.5E+01 | nc | 3.3E-01 | nc | 3.3E+00 | nc | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0.1 | 24307-26-4 | Mepiquat chloride | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| 2.9E-02 | n | 1.0E-01 | n | 2.9E-02 | r | 1.0E-01 | r | 0.1 | 149-30-4 | 2-Mercaptobenzothiazole | 1.7E+01 | ca | 5.9E+01 | ca | 2.3E-01 | ca | 2.3E+00 | ca | | |
| | | 3.0E-04 | i | | | | | | 7487-94-7 | Mercury and compounds | 2.3E+01 | nc | 3.1E+02 | nc | | | 1.1E+01 | nc | | |
| | | | | | | 8.6E-05 | i | | 7439-97-6 | Mercury (elemental) | | | | | 3.1E-01 | nc | | | | |
| | | 1.0E-04 | i | | | | | 0.1 | 22967-92-6 | Mercury (methyl) | 6.1E+00 | nc | 6.2E+01 | nc | | | 3.6E+00 | nc | | |
| | | 3.0E-05 | i | | | 3.0E-05 | r | 0.1 | 150-50-5 | Merphos | 1.8E+00 | nc | 1.8E+01 | nc | 1.1E-01 | nc | 1.1E+00 | nc | | |
| | | 3.0E-05 | i | | | 3.0E-05 | r | 0.1 | 78-48-8 | Merphos oxide | 1.8E+00 | nc | 1.8E+01 | nc | 1.1E-01 | nc | 1.1E+00 | nc | | |
| | | 6.0E-02 | i | | | 6.0E-02 | r | 0.1 | 57837-19-1 | Metalaxyl | 3.7E+03 | nc | 3.7E+04 | nc | 2.2E+02 | nc | 2.2E+03 | nc | | |
| | | 1.0E-04 | i | | | 2.0E-04 | h | y | 126-98-7 | Methacrylonitrile | 2.1E+00 | nc | 8.4E+00 | nc | 7.3E-01 | nc | 1.0E+00 | nc | | |
| | | 5.0E-05 | i | | | 5.0E-05 | r | 0.1 | 10265-92-6 | Methamidophos | 3.1E+00 | nc | 3.1E+01 | nc | 1.8E-01 | nc | 1.8E+00 | nc | | |
| | | 5.0E-01 | i | | | 5.0E-01 | r | 0.1 | 67-56-1 | Methanol | 3.1E+04 | nc | 1.0E+05 | max | 1.8E+03 | nc | 1.8E+04 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0.1 | 950-37-8 | Methidathion | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | y | 16752-77-5 | Methomyl | 4.4E+01 | nc | 1.5E+02 | nc | 9.1E+01 | nc | 1.5E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0.1 | 72-43-5 | Methoxychlor | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | 1.6E+02 | 8.0E+00 |
| | | 1.0E-03 | h | | | 5.7E-03 | i | 0.1 | 109-86-4 | 2-Methoxyethanol | 6.1E+01 | nc | 6.2E+02 | nc | 2.1E+01 | nc | 3.6E+01 | nc | | |
| | | 2.0E-03 | h | | | 2.0E-03 | r | 0.1 | 110-49-6 | 2-Methoxyethanol acetate | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| 4.6E-02 | h | | | 4.6E-02 | r | | | 0.1 | 99-59-2 | 2-Methoxy-5-nitroaniline | 1.1E+01 | ca | 3.7E+01 | ca | 1.5E-01 | ca | 1.5E+00 | ca | | |
| | | 1.0E+00 | h | | | 1.0E+00 | r | y | 79-20-9 | Methyl acetate | 2.2E+04 | nc | 9.2E+04 | nc | 3.7E+03 | nc | 6.1E+03 | nc | | |
| | | 3.0E-02 | h | | | 3.0E-02 | r | y | 96-33-3 | Methyl acrylate | 7.0E+01 | nc | 2.3E+02 | nc | 1.1E+02 | nc | 1.8E+02 | nc | | |
| 2.4E-01 | h | | | 2.4E-01 | r | | | 0.1 | 95-53-4 | 2-Methylaniline (o-toluidine) | 2.0E+00 | ca | 7.2E+00 | ca | 2.8E-02 | ca | 2.8E-01 | ca | | |
| 1.8E-01 | h | | | 1.8E-01 | r | | | 0.1 | 636-21-5 | 2-Methylaniline hydrochloride | 2.7E+00 | ca | 9.6E+00 | ca | 3.7E-02 | ca | 3.7E-01 | ca | | |
| | | 5.0E-04 | i | | | 5.0E-04 | r | 0.1 | 94-74-6 | 2-Methyl-4-chlorophenoxyacetic acid | 3.1E+01 | nc | 3.1E+02 | nc | 1.8E+00 | nc | 1.8E+01 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 94-81-5 | 4-(2-Methyl-4-chlorophenoxy) butyric acid | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0.1 | 93-65-2 | 2-(2-Methyl-4-chlorophenoxy) propionic acid | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0.1 | 16484-77-8 | 2-(2-Methyl-1,4-chlorophenoxy) propionic acid | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 8.6E-01 | r | | | 8.6E-01 | h | y | 108-87-2 | Methylcyclohexane | 2.6E+03 | nc | 8.7E+03 | nc | 3.1E+03 | nc | 5.2E+03 | nc | | |
| 2.5E-01 | h | | | 2.5E-01 | r | | | 0.1 | 101-77-9 | 4,4'-Methylenebisbenzeneamine | 1.9E+00 | ca | 6.9E+00 | ca | 2.7E-02 | ca | 2.7E-01 | ca | | |
| 1.3E-01 | h | 7.0E-04 | h | 1.3E-01 | h | 7.0E-04 | r | 0.1 | 101-14-4 | 4,4'-Methylene bis(2-chloroaniline) | 3.7E+00 | ca* | 1.3E+01 | ca* | 5.2E-02 | ca* | 5.2E-01 | ca* | | |
| 4.6E-02 | i | | | 4.6E-02 | r | | | 0.1 | 101-61-1 | 4,4'-Methylene bis(N,N'-dimethyl)aniline | 1.1E+01 | ca | 3.7E+01 | ca | 1.5E-01 | ca | 1.5E+00 | ca | | |
| | | 1.0E-02 | h | | | 1.0E-02 | r | y | 74-95-3 | Methylene bromide | 6.7E+01 | nc | 2.3E+02 | nc | 3.7E+01 | nc | 6.1E+01 | nc | | |
| 7.5E-03 | i | 6.0E-02 | i | 1.6E-03 | i | 8.6E-01 | h | y | 75-09-2 | Methylene chloride | 9.1E+00 | ca | 2.1E+01 | ca | 4.1E+00 | ca | 4.3E+00 | ca | 2.0E-02 | 1.0E-03 |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C / skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 1.7E-04 | r | | | 1.7E-04 | i | 0.1 | 101-68-8 | 4,4'-Methylene diphenyl diisocyanate | 1.0E+01 | nc | 1.0E+02 | nc | 6.2E-01 | nc | 6.2E+00 | nc | | |
| | | 6.0E-01 | i | | | 1.4E+00 | i y | | 78-93-3 | **Methyl ethyl ketone (2-Butanone)** | 2.2E+04 | nc | 1.1E+05 | nc | 5.1E+03 | nc | 7.0E+03 | nc | | |
| | | 8.0E-02 | h | | | 8.6E-01 | i y | | 108-10-1 | **Methyl isobutyl ketone** | 5.3E+03 | nc | 4.7E+04 | nc | 3.1E+03 | nc | 2.0E+03 | nc | | |
| | | 5.7E-04 | r | | | 5.7E-04 | n | 0.1 | 74-93-1 | Methyl Mercaptan | 3.5E+01 | nc | 3.5E+02 | nc | 2.1E+00 | nc | 2.1E+01 | nc | | |
| | | 1.4E+00 | i | | | 2.0E-01 | i y | | 80-62-6 | Methyl methacrylate | 2.2E+03 | nc | 2.7E+03 | sat | 7.3E+02 | nc | 1.4E+03 | nc | | |
| 3.3E-02 | h | | | 3.3E-02 | r | | | 0.1 | 99-55-8 | 2-Methyl-5-nitroaniline | 1.5E+01 | ca | 5.2E+01 | ca | 2.0E-01 | ca | 2.0E+00 | ca | | |
| | | 2.5E-04 | i | | | 2.5E-04 | r | 0.1 | 298-00-0 | Methyl parathion | 1.5E+01 | nc | 1.5E+02 | nc | 9.1E-01 | nc | 9.1E+00 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 95-48-7 | 2-Methylphenol | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | 1.5E+01 | 8.0E-01 |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 108-39-4 | 3-Methylphenol | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 5.0E-03 | h | | | 5.0E-03 | r | 0.1 | 106-44-5 | 4-Methylphenol | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.0E-02 | p | | | 2.0E-02 | r | 0.1 | 993-13-5 | Methyl phosphonic acid | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 6.0E-03 | h | | | 1.1E-02 | h y | | 25013-15-4 | Methyl styrene (mixture) | 1.3E+02 | nc | 5.4E+02 | nc | 4.2E+01 | nc | 6.0E+01 | nc | | |
| | | 7.0E-02 | h | | | 7.0E-02 | r y | | 98-83-9 | Methyl styrene (alpha) | 6.8E+02 | sat | 6.8E+02 | sat | 2.6E+02 | nc | 4.3E+02 | nc | | |
| 1.8E-03 | c | 8.6E-01 | r | 9.1E-04 | c | 8.6E-01 | i y | | 1634-04-4 | **Methyl tertbutyl ether (MTBE)** | 3.2E+01 | ca | 7.0E+01 | ca | 7.4E+00 | ca | 1.1E+01 | ca | | |
| | | 1.5E-01 | i | | | 1.5E-01 | r | 0.1 | 51218-45-2 | Metolaclor (Dual) | 9.2E+03 | nc | 9.2E+04 | nc | 5.5E+02 | nc | 5.5E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0.1 | 21087-64-9 | Metribuzin | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| 1.8E+00 | x | 2.0E-04 | i | 1.8E+00 | r | 2.0E-04 | r | 0.1 | 2385-85-5 | Mirex | 2.7E-01 | ca* | 9.6E-01 | ca | 3.7E-03 | ca | 3.7E-02 | ca | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0.1 | 2212-67-1 | Molinate | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 5.0E-03 | i | | | | | | 7439-98-7 | Molybdenum | 3.9E+02 | nc | 5.1E+03 | nc | | | 1.8E+02 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0.1 | 10599-90-3 | Monochloramine | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0.1 | 300-76-5 | Naled | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0.1 | 15299-99-7 | Napropamide | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 2.0E-02 | i | | | | | | 7440-02-0 | Nickel (soluble salts) | 1.6E+03 | nc | 2.0E+04 | nc | | | 7.3E+02 | nc | 1.3E+02 | 7.0E+00 |
| | | | | 8.4E-01 | i | | | | | Nickel refinery dust | | | | | 8.0E-03 | ca | | | | |
| | | | | 1.7E+00 | i | | | | 12035-72-2 | Nickel subsulfide | | | 1.1E+04 | ca | 4.0E-03 | ca | | | | |
| Tap Water PRG Based on Infant NOAEL (see IRIS) | | | | | | | | | 14797-55-8 | Nitrate+++ | | | | | | | 1.0E+04 | nc | | |
| Tap Water PRG Based on Infant NOAEL (see IRIS) | | | | | | | | | 14797-65-0 | Nitrite+++ | | | | | | | 1.0E+03 | nc | | |
| | | 3.0E-03 | p | | | 3.0E-05 | p | 0.1 | 88-74-4 | **2-Nitroaniline** | 1.8E+02 | nc | 1.8E+03 | nc | 1.1E-01 | nc | 1.1E+02 | nc | | |
| 2.1E-02 | p | 3.0E-04 | p | 2.1E-02 | r | 3.0E-04 | p | 0.1 | 99-09-2 | **3-Nitroaniline** | 1.8E+01 | nc | 8.2E+01 | ca** | 3.2E-01 | ca** | 3.2E+00 | ca** | | |
| 2.1E-02 | p | 3.0E-03 | p | 2.1E-02 | r | 1.0E-03 | p | 0.1 | 100-01-6 | **4-Nitroaniline** | 2.3E+01 | ca** | 8.2E+01 | ca* | 3.2E-01 | ca* | 3.2E+00 | ca* | | |
| | | 5.0E-04 | i | | | 5.7E-04 | h y | | 98-95-3 | Nitrobenzene | 2.0E+01 | nc | 1.0E+02 | nc | 2.1E+00 | nc | 3.4E+00 | nc | 1.0E-01 | 7.0E-03 |
| | | 7.0E-02 | h | | | 7.0E-02 | r | 0.1 | 67-20-9 | Nitrofurantoin | 4.3E+03 | nc | 4.3E+04 | nc | 2.6E+02 | nc | 2.6E+03 | nc | | |
| 1.5E+00 | h | | | 1.5E+00 | r | | | 0.1 | 59-87-0 | Nitrofurazone | 3.2E-01 | ca | 1.1E+00 | ca | 4.5E-03 | ca | 4.5E-02 | ca | | |
| 1.4E-02 | n | | | 1.4E-02 | r | | | 0.1 | 55-63-0 | Nitroglycerin | 3.5E+01 | ca | 1.2E+02 | ca | 4.8E-01 | ca | 4.8E+00 | ca | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0.1 | 556-88-7 | Nitroguanidine | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| 9.4E+00 | r | 5.7E-03 | r | 9.4E+00 | h | 5.7E-03 | i y | | 79-46-9 | 2-Nitropropane | | | | | 7.2E-04 | ca | 1.2E-03 | ca | | |
| 5.4E+00 | i | | | 5.6E+00 | i | | y | | 924-16-3 | N-Nitrosodi-n-butylamine | 2.4E-02 | ca | 5.8E-02 | ca | 1.2E-03 | ca | 2.0E-03 | ca | | |
| 2.8E+00 | i | | | 2.8E+00 | r | | | 0.1 | 1116-54-7 | N-Nitrosodiethanolamine | 1.7E-01 | ca | 6.2E-01 | ca | 2.4E-03 | ca | 2.4E-02 | ca | | |
| 1.5E+02 | i | | | 1.5E+02 | i | | | 0.1 | 55-18-5 | N-Nitrosodiethylamine | 3.2E-03 | ca | 1.1E-02 | ca | 4.5E-05 | ca | 4.5E-04 | ca | | |
| 5.1E+01 | i | 8.0E-06 | p | 4.9E+01 | i | 8.0E-06 | r | 0.1 | 62-75-9 | **N-Nitrosodimethylamine** | 9.5E-03 | ca* | 3.4E-02 | ca | 1.4E-04 | ca | 1.3E-03 | ca | | |
| 4.9E-03 | i | 2.0E-02 | p | 4.9E-03 | r | 2.0E-02 | r | 0.1 | 86-30-6 | **N-Nitrosodiphenylamine** | 9.9E+01 | ca* | 3.5E+02 | ca* | 1.4E+00 | ca* | 1.4E+01 | ca* | 1.0E+00 | 6.0E-02 |
| 7.0E+00 | i | | | 7.0E+00 | r | | | 0.1 | 621-64-7 | N-Nitroso di-n-propylamine | 6.9E-02 | ca | 2.5E-01 | ca | 9.6E-04 | ca | 9.6E-03 | ca | 5.0E-05 | 2.0E-06 |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | V O C / skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| 2.2E+01 | i | | | 2.2E+01 | r | | 0.1 | 10595-95-6 | N-Nitroso-N-methylethylamine | 2.2E-02 | ca | 7.8E-02 | ca | 3.1E-04 | ca | 3.1E-03 | ca | | |
| 2.1E+00 | i | | | 2.1E+00 | i | | 0.1 | 930-55-2 | N-Nitrosopyrrolidine | 2.3E-01 | ca | 8.2E-01 | ca | 3.1E-03 | ca | 3.2E-02 | ca | | |
| | | 2.0E-02 | p | | | 2.0E-02 | r y | 99-08-1 | **m-Nitrotoluene** | 7.3E+02 | nc | 1.0E+03 | sat | 7.3E+01 | nc | 1.2E+02 | nc | | |
| 2.3E-01 | p | 1.0E-02 | h | 2.3E-01 | r | 1.0E-02 | r y | 88-72-2 | **o-Nitrotoluene** | 8.8E-01 | ca | 2.2E+00 | ca | 2.9E-02 | ca | 4.9E-02 | ca | | |
| 1.7E-02 | p | 1.0E-02 | p | 1.7E-02 | r | 1.0E-02 | r y | 99-99-0 | **p-Nitrotoluene** | 1.2E+01 | ca* | 3.0E+01 | ca* | 4.0E-01 | ca* | 6.6E-01 | ca* | | |
| | | 4.0E-02 | i | | | 4.0E-02 | r | 0.1 | 27314-13-2 | Norflurazon | 2.4E+03 | nc | 2.5E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | | |
| | | 7.0E-04 | i | | | 7.0E-04 | r | 0.1 | 85509-19-9 | NuStar | 4.3E+01 | nc | 4.3E+02 | nc | 2.6E+00 | nc | 2.6E+01 | nc | | |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0.1 | 32536-52-0 | Octabromodiphenyl ether | 1.8E+02 | nc | 1.8E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 2.0E-03 | h | | | 2.0E-03 | r | 0.1 | 152-16-9 | Octamethylpyrophosphoramide | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 19044-88-3 | Oryzalin | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0.1 | 19666-30-9 | Oxadiazon | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0.1 | 23135-22-0 | Oxamyl | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0.1 | 42874-03-3 | Oxyfluorfen | 1.8E+02 | nc | 1.8E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0.1 | 76738-62-0 | Paclobutrazol | 7.9E+02 | nc | 8.0E+03 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 4.5E-03 | i | | | 4.5E-03 | r | 0.1 | 4685-14-7 | Paraquat | 2.7E+02 | nc | 2.8E+03 | nc | 1.6E+01 | nc | 1.6E+02 | nc | | |
| | | 6.0E-03 | h | | | 6.0E-03 | r | 0.1 | 56-38-2 | Parathion | 3.7E+02 | nc | 3.7E+03 | nc | 2.2E+01 | nc | 2.2E+02 | nc | | |
| | | 5.0E-02 | h | | | 5.0E-02 | r | 0.1 | 1114-71-2 | Pebulate | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 4.0E-02 | i | | | 4.0E-02 | r | 0.1 | 40487-42-1 | Pendimethalin | 2.4E+03 | nc | 2.5E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | | |
| 2.3E-02 | h | | | 2.3E-02 | r | | | 0.1 | 87-84-3 | Pentabromo-6-chloro cyclohexane | 2.1E+01 | ca | 7.5E+01 | ca | 2.9E-01 | ca | 2.9E+00 | ca | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0.1 | 32534-81-9 | Pentabromodiphenyl ether | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 8.0E-04 | i | | | 8.0E-04 | r | 0.1 | 608-93-5 | Pentachlorobenzene | 4.9E+01 | nc | 4.9E+02 | nc | 2.9E+00 | nc | 2.9E+01 | nc | | |
| 2.6E-01 | h | 3.0E-03 | i | 2.6E-01 | r | 3.0E-03 | r | 0.1 | 82-68-8 | Pentachloronitrobenzene | 1.9E+00 | ca* | 6.6E+00 | ca | 2.6E-02 | ca | 2.6E-01 | ca | | |
| 1.2E-01 | i | 3.0E-02 | i | 1.2E-01 | r | 3.0E-02 | r | 0.25 | 87-86-5 | Pentachlorophenol | 3.0E+00 | ca | 9.0E+00 | ca | 5.6E-02 | ca | 5.6E-01 | ca | 3.0E-02 | 1.0E-03 |
| | | 1.0E-04 | n | | | | | | 7601-90-3 | Perchlorate | 7.8E+00 | ca/nc | 1.0E+02 | ca/nc | | | 3.6E+00 | ca/nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 52645-53-1 | Permethrin | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 2.5E-01 | i | | | 2.5E-01 | r | 0.1 | 13684-63-4 | Phenmedipham | 1.5E+04 | nc | 1.0E+05 | max | 9.1E+02 | nc | 9.1E+03 | nc | | |
| | | 3.0E-01 | i | | | 3.0E-01 | r | 0.1 | 108-95-2 | **Phenol** | 1.8E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.1E+04 | nc | 1.0E+02 | 5.0E+00 |
| | | 2.0E-03 | n | | | 2.0E-03 | r | 0.1 | 92-84-2 | Phenothiazine | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 6.0E-03 | i | | | 6.0E-03 | r | 0.1 | 108-45-2 | m-Phenylenediamine | 3.7E+02 | nc | 3.7E+03 | nc | 2.2E+01 | nc | 2.2E+02 | nc | | |
| 4.7E-02 | h | | | 4.7E-02 | r | | | 0.1 | 95-54-5 | **o-Phenylenediamine** | 1.0E+01 | ca | 3.7E+01 | ca | 1.4E-01 | ca | 1.4E+00 | ca | | |
| | | 1.9E-01 | h | | | 1.9E-01 | r | 0.1 | 106-50-3 | p-Phenylenediamine | 1.2E+04 | nc | 1.0E+05 | max | 6.9E+02 | nc | 6.9E+03 | nc | | |
| | | 8.0E-05 | i | | | 8.0E-05 | r | 0.1 | 62-38-4 | Phenylmercuric acetate | 4.9E+00 | nc | 4.9E+01 | nc | 2.9E-01 | nc | 2.9E+00 | nc | | |
| 1.9E-03 | h | | | 1.9E-03 | r | | | 0.1 | 90-43-7 | 2-Phenylphenol | 2.5E+02 | ca | 8.9E+02 | ca | 3.5E+00 | ca | 3.5E+01 | ca | | |
| | | 2.0E-04 | h | | | 2.0E-04 | r | 0.1 | 298-02-2 | Phorate | 1.2E+01 | nc | 1.2E+02 | nc | 7.3E-01 | nc | 7.3E+00 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 732-11-6 | Phosmet | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 3.0E-04 | i | | | 8.6E-05 | i | 0.1 | 7803-51-2 | Phosphine | 1.8E+01 | nc | 1.8E+02 | nc | 3.1E-01 | nc | 1.1E+01 | nc | | |
| | | | | | | 2.9E-03 | i | | 7664-38-2 | Phosphoric acid | | | | | 1.0E+01 | nc | | | | |
| | | 2.0E-05 | i | | | | | | 7723-14-0 | Phosphorus (white) | 1.6E+00 | nc | 2.0E+01 | nc | | | 7.3E-01 | nc | | |
| | | 1.0E+00 | h | | | 1.0E+00 | r | 0.1 | 100-21-0 | p-Phthalic acid | 6.1E+04 | nc | 1.0E+05 | max | 3.7E+03 | nc | 3.6E+04 | nc | | |
| | | 2.0E+00 | i | | | 3.4E-02 | h | 0.1 | 85-44-9 | Phthalic anhydride | 1.0E+05 | max | 1.0E+05 | max | 1.2E+02 | nc | 7.3E+04 | nc | | |
| | | 7.0E-02 | i | | | 7.0E-02 | r | 0.1 | 1918-02-1 | Picloram | 4.3E+03 | nc | 4.3E+04 | nc | 2.6E+02 | nc | 2.6E+03 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 29232-93-7 | Pirimiphos-methyl | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG) ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | V O C | skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| 8.9E+00 | h | 7.0E-06 | h | 8.9E+00 | r | 7.0E-06 | r | 0.1 | | Polybrominated biphenyls | 5.5E-02 | ca** | 1.9E-01 | ca* | 7.6E-04 | ca* | 7.6E-03 | ca* | | |
| | | | | | | | | | | Polychlorinated biphenyls (PCBs, see IRIS) | | | | | | | | | | |
| 7.0E-02 | i | 7.0E-05 | i | 7.0E-02 | i | 7.0E-05 | r | 0.14 | 12674-11-2 | PCBs (unspeciated mixture, low risk, e.g. Aroclor 1016) | 3.9E+00 | nc | 2.1E+01 | ca** | 9.6E-02 | ca** | 9.6E-01 | ca** | | |
| 2.0E+00 | i | 2.0E-05 | i | 2.0E+00 | i | 2.0E-05 | r | 0.14 | 11097-69-1 | PCBs (unspeciated mixture, high risk, e.g. Aroclor 1254) | 2.2E-01 | ca** | 7.4E-01 | ca* | 3.4E-03 | ca* | 3.4E-02 | ca* | | |
| 4.5E+00 | n | | | 4.5E+00 | r | | | 0.1 | 61788-33-8 | Polychlorinated terphenyls | 1.1E-01 | ca | 3.8E-01 | ca | 1.5E-03 | ca | 1.5E-02 | ca | | |
| | | | | | | | | | | Polynuclear aromatic hydrocarbons (PAHs) | | | | | | | | | | |
| | | 6.0E-02 | i | | | 6.0E-02 | r | y | 83-32-9 | Acenaphthene | 3.7E+03 | nc | 2.9E+04 | nc | 2.2E+02 | nc | 3.7E+02 | nc | 5.7E+02 | 2.9E+01 |
| | | 3.0E-01 | i | | | 3.0E-01 | r | y | 120-12-7 | Anthracene | 2.2E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.8E+03 | nc | 1.2E+04 | 5.9E+02 |
| 7.3E-01 | n | | | 7.3E-01 | r | | | 0.13 | 56-55-3 | Benz[a]anthracene | 6.2E-01 | ca | 2.1E+00 | ca | 9.2E-03 | ca | 9.2E-02 | ca | 2.0E+00 | 8.0E-02 |
| 7.3E-01 | n | | | 7.3E-01 | r | | | 0.13 | 205-99-2 | Benzo[b]fluoranthene | 6.2E-01 | ca | 2.1E+00 | ca | 9.2E-03 | ca | 9.2E-02 | ca | 5.0E+00 | 2.0E-01 |
| 7.3E-02 | n | | | 7.3E-02 | r | | | 0.13 | 207-08-9 | Benzo[k]fluoranthene | 6.2E+00 | ca | 2.1E+01 | ca | 9.2E-02 | ca | 9.2E-01 | ca | 4.9E+01 | 2.0E+00 |
| 1.2E+00 | c | | | 3.9E-01 | c | | | 0.13 | 207-08-9 | "CAL-Modified PRG" | 3.8E-01 | ca | 1.3E+00 | ca | 1.7E-02 | ca | 5.6E-02 | ca | | |
| 7.3E+00 | i | | | 7.3E+00 | r | | | 0.13 | 50-32-8 | Benzo[a]pyrene | 6.2E-02 | ca | 2.1E-01 | ca | 9.2E-04 | ca | 9.2E-03 | ca | 8.0E+00 | 4.0E-01 |
| 7.3E-03 | n | | | 7.3E-03 | r | | | 0.13 | 218-01-9 | Chrysene | 6.2E+01 | ca | 2.1E+02 | ca | 9.2E-01 | ca | 9.2E+00 | ca | 1.6E+02 | 8.0E+00 |
| 1.2E-01 | c | | | 3.9E-02 | c | | | 0.13 | | "CAL-Modified PRG" | 3.8E+00 | ca | 1.3E+01 | ca | 1.7E-01 | ca | 5.6E-01 | ca | | |
| 7.3E+00 | n | | | 7.3E+00 | r | | | 0.13 | 53-70-3 | Dibenz[ah]anthracene | 6.2E-02 | ca | 2.1E-01 | ca | 9.2E-04 | ca | 9.2E-03 | ca | 2.0E+00 | 8.0E-02 |
| | | 4.0E-02 | i | | | 4.0E-02 | r | 0.13 | 206-44-0 | Fluoranthene | 2.3E+03 | nc | 2.2E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | 4.3E+03 | 2.1E+02 |
| | | 4.0E-02 | i | | | 4.0E-02 | r | y | 86-73-7 | Fluorene | 2.7E+03 | nc | 2.6E+04 | nc | 1.5E+02 | nc | 2.4E+02 | nc | 5.6E+02 | 2.8E+01 |
| 7.3E-01 | n | | | 7.3E-01 | r | | | 0.13 | 193-39-5 | Indeno[1,2,3-cd]pyrene | 6.2E-01 | ca | 2.1E+00 | ca | 9.2E-03 | ca | 9.2E-02 | ca | 1.4E+01 | 7.0E-01 |
| | | 2.0E-02 | i | | | 8.6E-04 | i | y | 91-20-3 | Naphthalene | 5.6E+01 | nc | 1.9E+02 | nc | 3.1E+00 | nc | 6.2E+00 | nc | 8.4E+01 | 4.0E+00 |
| 1.2E-01 | r | | | 1.2E-01 | c | | | | | **"CAL-Modified PRG"** | 1.7E+00 | ca | 4.2E+00 | ca | 5.6E-02 | ca | 9.3E-02 | ca | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | y | 129-00-0 | Pyrene | 2.3E+03 | nc | 2.9E+04 | nc | 1.1E+02 | nc | 1.8E+02 | nc | 4.2E+03 | 2.1E+02 |
| 1.5E-01 | i | 9.0E-03 | i | 1.5E-01 | r | 9.0E-03 | r | 0.1 | 67747-09-5 | Prochloraz | 3.2E+00 | ca | 1.1E+01 | ca | 4.5E-02 | ca | 4.5E-01 | ca | | |
| | | 6.0E-03 | h | | | 6.0E-03 | r | 0.1 | 26399-36-0 | Profluralin | 3.7E+02 | nc | 3.7E+03 | nc | 2.2E+01 | nc | 2.2E+02 | nc | | |
| | | 1.5E-02 | i | | | 1.5E-02 | r | 0.1 | 1610-18-0 | Prometon | 9.2E+02 | nc | 9.2E+03 | nc | 5.5E+01 | nc | 5.5E+02 | nc | | |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0.1 | 7287-19-6 | Prometryn | 2.4E+02 | nc | 2.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | | |
| | | 7.5E-02 | i | | | 7.5E-02 | r | 0.1 | 23950-58-5 | Pronamide | 4.6E+03 | nc | 4.6E+04 | nc | 2.7E+02 | nc | 2.7E+03 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0.1 | 1918-16-7 | Propachlor | 7.9E+02 | nc | 8.0E+03 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0.1 | 709-98-8 | Propanil | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 2312-35-8 | Propargite | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0.1 | 107-19-7 | Propargyl alcohol | 1.2E+02 | nc | 1.2E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 139-40-2 | Propazine | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0.1 | 122-42-9 | Propham | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0.1 | 60207-90-1 | Propiconazole | 7.9E+02 | nc | 8.0E+03 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | | | | | | | | 98-82-8 | Isopropylbenzene (see Cumene) | | | | | | | | | | |
| | | 4.0E-02 | n | | | 4.0E-02 | r | y | 103-65-1 | n-Propylbenzene | 2.4E+02 | sat | 2.4E+02 | sat | 1.5E+02 | nc | 2.4E+02 | nc | | |
| | | 5.0E-01 | p | | | 8.6E-04 | p | 0.1 | 57-55-6 | Propylene glycol | 3.0E+04 | nc | 1.0E+05 | max | 3.1E+00 | nc | 1.8E+04 | nc | | |
| | | 7.0E-01 | h | | | 7.0E-01 | r | 0.1 | 52125-53-8 | Propylene glycol, monoethyl ether | 4.3E+04 | nc | 1.0E+05 | max | 2.6E+03 | nc | 2.6E+04 | nc | | |
| | | 7.0E-01 | h | | | 5.7E-01 | i | 0.1 | 107-98-2 | Propylene glycol, monomethyl ether | 4.3E+04 | nc | 1.0E+05 | max | 2.1E+03 | nc | 2.6E+04 | nc | | |
| 2.4E-01 | i | 8.6E-03 | r | 1.3E-02 | i | 8.6E-03 | i | y | 75-56-9 | Propylene oxide | 1.9E+00 | ca* | 6.6E+00 | ca* | 5.2E-01 | ca* | 2.2E-01 | ca | | |
| | | 2.5E-01 | i | | | 2.5E-01 | r | 0.1 | 81335-77-5 | Pursuit | 1.5E+04 | nc | 1.0E+05 | max | 9.1E+02 | nc | 9.1E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0.1 | 51630-58-1 | Pydrin | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C / skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0.1 | 110-86-1 | Pyridine | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 5.0E-04 | i | | | 5.0E-04 | r | 0.1 | 13593-03-8 | Quinalphos | 3.1E+01 | nc | 3.1E+02 | nc | 1.8E+00 | nc | 1.8E+01 | nc | | |
| 3.0E+00 | i | | | 3.0E+00 | r | | | 0.1 | 91-22-5 | Quinoline | 1.6E-01 | ca | 5.7E-01 | ca | 2.2E-03 | ca | 2.2E-02 | ca | | |
| 1.1E-01 | i | 3.0E-03 | i | 1.1E-01 | r | 3.0E-03 | r | 0.1 | 121-82-4 | RDX (Cyclonite) | 4.4E+00 | ca* | 1.6E+01 | ca | 6.1E-02 | ca | 6.1E-01 | ca | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0.1 | 10453-86-8 | Resmethrin | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 5.0E-02 | h | | | 5.0E-02 | r | 0.1 | 299-84-3 | Ronnel | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0.1 | 83-79-4 | Rotenone | 2.4E+02 | nc | 2.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0.1 | 78587-05-0 | Savey | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 5.0E-03 | i | | | | | 0.1 | 7783-00-8 | Selenious Acid | 3.1E+02 | nc | 3.1E+03 | nc | | | 1.8E+02 | nc | | |
| | | 5.0E-03 | i | | | | | | 7782-49-2 | Selenium | 3.9E+02 | nc | 5.1E+03 | nc | | | 1.8E+02 | nc | 5.0E+00 | 3.0E-01 |
| | | 5.0E-03 | h | | | | | 0.1 | 630-10-4 | Selenourea | 3.1E+02 | nc | 3.1E+03 | nc | | | 1.8E+02 | nc | | |
| | | 9.0E-02 | i | | | 9.0E-02 | r | 0.1 | 74051-80-2 | Sethoxydim | 5.5E+03 | nc | 5.5E+04 | nc | 3.3E+02 | nc | 3.3E+03 | nc | | |
| | | 5.0E-03 | i | | | | | | 7440-22-4 | Silver and compounds | 3.9E+02 | nc | 5.1E+03 | nc | | | 1.8E+02 | nc | 3.4E+01 | 2.0E+00 |
| 1.2E-01 | h | 5.0E-03 | i | 1.2E-01 | r | 5.00E-03 | r | 0.1 | 122-34-9 | Simazine | 4.1E+00 | ca* | 1.4E+01 | ca | 5.6E-02 | ca | 5.6E-01 | ca | | |
| | | 4.0E-03 | i | | | | | | 26628-22-8 | Sodium azide | | | | | | | | | | |
| 2.7E-01 | h | 3.0E-02 | i | 2.7E-01 | r | 3.0E-02 | r | 0.1 | 148-18-5 | Sodium diethyldithiocarbamate | 1.8E+00 | ca | 6.4E+00 | ca | 2.5E-02 | ca | 2.5E-01 | ca | | |
| | | 2.0E-05 | i | | | 2.0E-05 | r | 0.1 | 62-74-8 | Sodium fluoroacetate | 1.2E+00 | nc | 1.2E+01 | nc | 7.3E-02 | nc | 7.3E-01 | nc | | |
| | | 1.0E-03 | h | | | 1.0E-03 | r | 0.1 | 13718-26-8 | Sodium metavanadate | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 6.0E-01 | i | | | | | | 7440-24-6 | Strontium, stable | 4.7E+04 | nc | 1.0E+05 | max | | | 2.2E+04 | nc | | |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0.1 | 57-24-9 | Strychnine | 1.8E+01 | nc | 1.8E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| | | 2.0E-01 | i | | | 2.9E-01 | i | y | 100-42-5 | Styrene | 1.7E+03 | sat | 1.7E+03 | sat | 1.1E+03 | nc | 1.6E+03 | nc | 4.0E+00 | 2.0E-01 |
| | | 5.0E-03 | p | | | 5.0E-03 | r | | 80-07-9 | **1,1'-Sulfonylbis (4-chlorobenzene)** | 3.9E+02 | nc | 5.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0.1 | 88671-89-0 | Systhane | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| 1.5E+05 | h | | | 1.5E+05 | h | | | 0.03 | 1746-01-6 | 2,3,7,8-TCDD (dioxin) | 3.9E-06 | ca | 1.6E-05 | ca | 4.5E-08 | ca | 4.5E-07 | ca | | |
| | | 7.0E-02 | i | | | 7.0E-02 | r | 0.1 | 34014-18-1 | Tebuthiuron | 4.3E+03 | nc | 4.3E+04 | nc | 2.6E+02 | nc | 2.6E+03 | nc | | |
| | | 2.0E-02 | h | | | 2.0E-02 | r | 0.1 | 3383-96-8 | Temephos | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0.1 | 5902-51-2 | Terbacil | 7.9E+02 | nc | 8.0E+03 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 2.5E-05 | h | | | 2.5E-05 | r | 0.1 | 13071-79-9 | Terbufos | 1.5E+00 | nc | 1.5E+01 | nc | 9.1E-02 | nc | 9.1E-01 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0.1 | 886-50-0 | Terbutryn | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0.1 | 95-94-3 | 1,2,4,5-Tetrachlorobenzene | 1.8E+01 | nc | 1.8E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| 2.6E-02 | i | 3.0E-02 | i | 2.6E-02 | i | 3.0E-02 | r | y | 630-20-6 | 1,1,1,2-Tetrachloroethane | 3.2E+00 | ca | 7.3E+00 | ca | 2.6E-01 | ca | 4.3E-01 | ca | | |
| 2.0E-01 | i | 6.0E-02 | p | 2.0E-01 | i | 6.0E-02 | r | y | 79-34-5 | 1,1,2,2-Tetrachloroethane | 4.1E-01 | ca | 9.3E-01 | ca | 3.3E-02 | ca | 5.5E-02 | ca | 3.0E-03 | 2.0E-04 |
| 5.4E-01 | c | 1.0E-02 | i | 2.1E-02 | c | 1.0E-02 | c | y | 127-18-4 | **Tetrachloroethylene (PCE)** | 4.8E-01 | ca* | 1.3E+00 | ca | 3.2E-01 | ca | 1.0E-01 | ca | 6.0E-02 | 3.0E-03 |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0.1 | 58-90-2 | 2,3,4,6-Tetrachlorophenol | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| 2.0E+01 | h | | | 2.0E+01 | r | | | 0.1 | 5216-25-1 | p,a,a,a-Tetrachlorotoluene | 2.4E-02 | ca | 8.6E-02 | ca | 3.4E-04 | ca | 3.4E-03 | ca | | |
| 2.4E-02 | h | 3.0E-02 | i | 2.4E-02 | r | 3.0E-02 | r | 0.1 | 961-11-5 | Tetrachlorovinphos | 2.0E+01 | ca* | 7.2E+01 | ca | 2.8E-01 | ca | 2.8E+00 | ca | | |
| | | 5.0E-04 | i | | | 5.0E-04 | r | 0.1 | 3689-24-5 | Tetraethyldithiopyrophosphate | 3.1E+01 | nc | 3.1E+02 | nc | 1.8E+00 | nc | 1.8E+01 | nc | | |
| 7.6E-03 | n | 2.1E-01 | n | 6.8E-03 | n | 8.6E-02 | n | y | 109-99-9 | Tetrahydrofuran | 9.4E+00 | ca | 2.1E+01 | ca | 9.9E-01 | ca | 1.6E+00 | ca | | |
| | | 6.6E-05 | i | | | | | | 7440-28-0 | Thallium and compounds+++ | 5.2E+00 | nc | 6.7E+01 | nc | | | 2.4E+00 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 28249-77-6 | Thiobencarb | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 5.0E-02 | n | | | 5.0E-02 | r | 0.1 | N/A | Thiocyanate | 3.1E+03 | nc | 1.0E+05 | max | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 3.0E-04 | h | | | 3.0E-04 | r | 0.1 | 39196-18-4 | Thiofanox | 1.8E+01 | nc | 1.8E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C / skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 8.0E-02 | i | | | 8.0E-02 | r | 0.1 | 23564-05-8 | Thiophanate-methyl | 4.9E+03 | nc | 4.9E+04 | nc | 2.9E+02 | nc | 2.9E+03 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0.1 | 137-26-8 | Thiram | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 6.0E-01 | h | | | | | | 7440-31-5 | Tin (inorganic, also see tributyltin oxide) | 4.7E+04 | nc | 1.0E+05 | max | | | 2.2E+04 | nc | | |
| | | 4.0E+00 | n | | | 8.6E-03 | n | | 7440-32-6 | Titanium | 1.0E+05 | max | 1.0E+05 | max | 3.1E+01 | nc | 1.5E+05 | nc | | |
| | | 2.0E-01 | i | | | 1.1E-01 | i | y | 108-88-3 | Toluene | 5.2E+02 | sat | 5.2E+02 | sat | 4.0E+02 | nc | 7.2E+02 | nc | 1.2E+01 | 6.0E-01 |
| 3.2E+00 | h | | | 3.2E+00 | r | | | 0.1 | 95-80-7 | Toluene-2,4-diamine | 1.5E-01 | ca | 5.4E-01 | ca | 2.1E-03 | ca | 2.1E-02 | ca | | |
| | | 6.0E-01 | h | | | 6.0E-01 | r | 0.1 | 95-70-5 | Toluene-2,5-diamine | 3.7E+04 | nc | 1.0E+05 | max | 2.2E+03 | nc | 2.2E+04 | nc | | |
| | | 2.0E-01 | h | | | 2.0E-01 | r | 0.1 | 823-40-5 | Toluene-2,6-diamine | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |
| 1.9E-01 | i | | | 1.9E-01 | r | | | 0.1 | 106-49-0 | p-Toluidine | 2.6E+00 | ca | 9.1E+00 | ca | 3.5E-02 | ca | 3.5E-01 | ca | | |
| 1.1E+00 | i | | | 1.1E+00 | i | | | 0.1 | 8001-35-2 | Toxaphene | 4.4E-01 | ca | 1.6E+00 | ca | 6.0E-03 | ca | 6.1E-02 | ca | 3.1E+01 | 2.0E+00 |
| | | 7.5E-03 | i | | | 7.5E-03 | r | 0.1 | 66841-25-6 | Tralomethrin | 4.6E+02 | nc | 4.6E+03 | nc | 2.7E+01 | nc | 2.7E+02 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0.1 | 2303-17-5 | Triallate | 7.9E+02 | nc | 8.0E+03 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 82097-50-5 | Triasulfuron | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0.1 | 615-54-3 | 1,2,4-Tribromobenzene | 3.1E+02 | nc | 3.1E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| 9.2E-03 | p | 2.0E-01 | p | 9.2E-03 | r | 2.0E-01 | r | 0.1 | 126-73-8 | **Tributyl phosphate** | 5.3E+01 | ca | 1.9E+02 | ca | 7.3E-01 | ca | 7.3E+00 | ca | | |
| | | 3.0E-04 | i | | | | | 0.1 | 56-35-9 | Tributyltin oxide (TBTO) | 1.8E+01 | nc | 1.8E+02 | nc | | | 1.1E+01 | nc | | |
| 3.4E-02 | h | | | 3.4E-02 | r | | | 0.1 | 634-93-5 | 2,4,6-Trichloroaniline | 1.4E+01 | ca | 5.1E+01 | ca | 2.0E-01 | ca | 2.0E+00 | ca | | |
| 2.9E-02 | h | | | 2.9E-02 | r | | | 0.1 | 33663-50-2 | 2,4,6-Trichloroaniline hydrochloride | 1.7E+01 | ca | 5.9E+01 | ca | 2.3E-01 | ca | 2.3E+00 | ca | | |
| | | 1.0E-02 | i | | | 1.0E-03 | p | y | 120-82-1 | **1,2,4-Trichlorobenzene** | 6.2E+01 | nc | 2.2E+02 | nc | 3.7E+00 | nc | 7.2E+00 | nc | 5.0E+00 | 3.0E-01 |
| | | 2.8E-01 | n | | | 6.3E-01 | p | y | 71-55-6 | 1,1,1-Trichloroethane | 1.2E+03 | sat | 1.2E+03 | sat | 2.3E+03 | nc | 3.2E+03 | nc | 2.0E+00 | 1.0E-01 |
| 5.7E-02 | i | 4.0E-03 | i | 5.6E-02 | i | 4.0E-03 | r | y | 79-00-5 | 1,1,2-Trichloroethane | 7.3E-01 | ca* | 1.6E+00 | ca* | 1.2E-01 | ca | 2.0E-01 | ca | 2.0E-02 | 9.0E-04 |
| 4.0E-01 | n | 3.0E-04 | n | 4.0E-01 | n | 1.0E-02 | n | y | 79-01-6 | Trichloroethylene (TCE) | 5.3E-02 | ca | 1.1E-01 | ca | 1.7E-02 | ca | 2.8E-02 | ca | 6.0E-02 | 3.0E-03 |
| 1.3E-02 | c | | | 7.0E-03 | c | 1.7E-01 | c | y | 79-01-6 | **"CAL-Modified PRG"** | 2.9E+00 | ca | 6.5E+00 | ca | 9.6E-01 | ca | 1.4E+00 | ca | | |
| | | 3.0E-01 | i | | | 2.0E-01 | h | y | 75-69-4 | Trichlorofluoromethane | 3.9E+02 | nc | 2.0E+03 | sat | 7.3E+02 | nc | 1.3E+03 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0.1 | 95-95-4 | 2,4,5-Trichlorophenol | 6.1E+03 | nc | 6.2E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | 2.7E+02 | 1.4E+01 |
| 1.1E-02 | i | 1.0E-04 | n | 1.1E-02 | i | 1.0E-04 | r | 0.1 | 88-06-2 | 2,4,6-Trichlorophenol | 6.1E+00 | nc** | 6.2E+01 | nc** | 3.7E-01 | nc** | 3.6E+00 | nc** | 2.0E-01 | 8.0E-03 |
| 7.0E-02 | c | | | 7.0E-02 | c | | | 0.1 | 88-06-2 | "CAL-Modified PRG" | 6.9E+00 | ca | 2.5E+01 | ca | 9.6E-02 | ca | 9.6E-01 | ca | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0.1 | 93-76-5 | 2,4,5-Trichlorophenoxyacetic Acid | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 8.0E-03 | i | | | 8.0E-03 | r | 0.1 | 93-72-1 | 2-(2,4,5-Trichlorophenoxy) propionic acid | 4.9E+02 | nc | 4.9E+03 | nc | 2.9E+01 | nc | 2.9E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | y | 598-77-6 | **1,1,2-Trichloropropane** | 7.1E+01 | nc | 2.7E+02 | nc | 1.8E+01 | nc | 3.0E+01 | nc | | |
| 2.0E+00 | n | 6.0E-03 | i | 2.0E+00 | r | 1.4E-03 | n | y | 96-18-4 | **1,2,3-Trichloropropane** | 3.4E-02 | ca | 7.6E-02 | ca | 3.4E-03 | ca | 5.6E-03 | ca | | |
| | | 1.0E-02 | p | | | 3.0E-04 | p | y | 96-19-5 | **1,2,3-Trichloropropene** | 5.2E+00 | nc | 1.7E+01 | nc | 1.1E+00 | nc | 2.2E+00 | nc | | |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0.1 | 58138-08-2 | Tridiphane | 1.8E+02 | nc | 1.8E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 2.0E-03 | r | | | 2.0E-03 | i | y | 121-44-8 | Triethylamine | 2.3E+01 | nc | 8.6E+01 | nc | 7.3E+00 | nc | 1.2E+01 | nc | | |
| 7.7E-03 | i | 7.5E-03 | i | 7.7E-03 | r | 7.5E-03 | r | 0.1 | 1582-09-8 | Trifluralin | 6.3E+01 | ca** | 2.2E+02 | ca* | 8.7E-01 | ca* | 8.7E+00 | ca* | | |
| | | 1.4E-04 | r | | | 1.4E-04 | n | 0.1 | 552-30-7 | Trimellitic Anhydride (TMAN) | 8.6E+00 | nc | 8.6E+01 | nc | 5.1E-01 | nc | 5.1E+00 | | | |
| | | 5.0E-02 | p | | | 1.7E-03 | p | y | 95-63-6 | 1,2,4-Trimethylbenzene | 5.2E+01 | nc | 1.7E+02 | nc | 6.2E+00 | nc | 1.2E+01 | nc | | |
| | | 5.0E-02 | p | | | 1.7E-03 | p | y | 108-67-8 | 1,3,5-Trimethylbenzene | 2.1E+01 | nc | 7.0E+01 | nc | 6.2E+00 | nc | 1.2E+01 | nc | | |
| 3.7E-02 | h | | | 3.7E-02 | r | | | 0.1 | 512-56-1 | Trimethyl phosphate | 1.3E+01 | ca | 4.7E+01 | ca | 1.8E-01 | ca | 1.8E+00 | ca | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0.1 | 99-35-4 | 1,3,5-Trinitrobenzene | 1.8E+03 | nc | 1.8E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 1.0E-02 | h | | | 1.0E-02 | r | 0.1 | 479-45-8 | Trinitrophenylmethylnitramine | 6.1E+02 | nc | 6.2E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| 3.0E-02 | i | 5.0E-04 | i | 3.0E-02 | r | 5.0E-04 | r | 0.1 | 118-96-7 | 2,4,6-Trinitrotoluene | 1.6E+01 | ca** | 5.7E+01 | ca** | 2.2E-01 | ca** | 2.2E+00 | ca** | | |

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

| TOXICITY VALUES | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways" | | | | | | | | SOIL SCREENING LEVELS "Migration to Ground Water" | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | V O C | skin abs. soils | CAS No. | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 2.0E-02 | p | | | 2.0E-02 | r | 0.1 | 791-28-6 | **Triphenylphosphine oxide** | 1.2E+03 | nc | 1.2E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| 1.4E-02 | p | 3.1E-01 | p | 1.4E-02 | r | 3.1E-01 | r | 0.1 | 115-96-8 | **Tris(2-chloroethyl) phosphate** | 3.5E+01 | ca | 1.2E+02 | ca | 4.8E-01 | ca | 4.8E+00 | ca | | |
| 3.2E-03 | p | 1.0E-01 | p | 3.2E-03 | r | 1.0E-01 | r | 0.1 | 78-42-2 | **Tris(2-ethylhexyl) phosphate** | 1.5E+02 | ca* | 5.4E+02 | ca | 2.1E+00 | ca | 2.1E+01 | ca | | |
| | | 2.0E-04 | n | | | | | | 7440-61-1 | Uranium (chemical toxicity only) | 1.6E+01 | nc | 2.0E+02 | nc | | | 7.3E+00 | nc | | |
| | | 1.0E-03 | n | | | | | | 7440-62-2 | Vanadium and compounds | 7.8E+01 | nc | 1.0E+03 | nc | | | 3.6E+01 | nc | 6.0E+03 | 3.0E+02 |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0.1 | 1929-77-7 | Vernam | 6.1E+01 | nc | 6.2E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0.1 | 50471-44-8 | Vinclozolin | 1.5E+03 | nc | 1.5E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 1.0E+00 | h | | | 5.7E-02 | i | y | 108-05-4 | Vinyl acetate | 4.3E+02 | nc | 1.4E+03 | nc | 2.1E+02 | nc | 4.1E+02 | nc | 1.7E+02 | 8.0E+00 |
| 1.1E-01 | r | 8.6E-04 | r | 1.1E-01 | h | 8.6E-04 | i | y | 593-60-2 | Vinyl bromide (bromoethene) | 1.9E-01 | ca* | 4.2E-01 | ca* | 6.1E-02 | ca* | 1.0E-01 | ca* | | |
| 1.5E+00 | i | 3.0E-03 | i | 3.1E-02 | i | 2.9E-02 | i | y | 75-01-4 | Vinyl chloride (child/adult)+++ | 7.9E-02 | ca | | | 1.1E-01 | ca | 2.0E-02 | ca | 1.0E-02 | 7.0E-04 |
| 7.5E-01 | i | 3.0E-03 | i | 1.6E-02 | i | 2.9E-02 | i | y | 75-01-4 | Vinyl chloride (adult) | | | 7.5E-01 | ca | | | | | | |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0.1 | 81-81-2 | Warfarin | 1.8E+01 | nc | 1.8E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| | | 2.0E-01 | i | | | 2.9E-02 | i | y | 0.1 1330-20-7 | **Xylenes** | 2.7E+02 | nc | 4.2E+02 | sat | 1.1E+02 | nc | 2.1E+02 | nc | 2.1E+02 | 1.0E+01 |
| | | 3.0E-01 | i | | | | | | 7440-66-6 | Zinc | 2.3E+04 | nc | 1.0E+05 | max | | | 1.1E+04 | nc | 1.2E+04 | 6.2E+02 |
| | | 3.0E-04 | i | | | | | | 1314-84-7 | Zinc phosphide | 2.3E+01 | nc | 3.1E+02 | nc | | | 1.1E+01 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0.1 | 12122-67-7 | Zineb | 3.1E+03 | nc | 3.1E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |

APPENDIX D

# Electronic Data Deliverable Format for CH2M HILL

March 6, 2000 Revision
Laboratory Electronic Deliverable Format for CH2M HILL, version 4.00
Sources: Vito D'Aurora/RDD, Ed Svastits/GNV

## Electronic Data Deliverable Format for CH2M HILL

The electronic data deliverable (EDD) file from the laboratory will be a comma-delimited ASCII (CDA) file in the format listed below. There will be one file per hard copy report and the filename of the EDD file will be in the format REPORTID.txt or REPORTID.csv, where REPORTID is the hard copy report identifier of sample delivery group.

The first row of the EDD will contain the 47 field name values as listed in the EDD Specification Table

The EDD Specification Table lists the attributes of the columns for each row of the CDA file. The fields should be reported in the order indicated.

The **Data Type** column describes the value in the field as either text (alphanumeric), number (numeric only), date (format: mm/dd/yyyy), or time (24-hour format hh:mm). If the field is conditional or optional and there is no value to be reported, report a null (i.e., no) value. For a text field, do not report a zero-length string (i.e., "").

The **Data Length** column contains the maximum length of a text value for the particular data field.

The **Rqmt** column contains a code indicating whether the value is required (R) for all rows, optional (O) for all rows, or conditional (C) and depends on the type of result reported.

March 6, 2000 Revision
Laboratory Electronic Deliverable Format for CH2M HILL, version 4.00
Sources: Vito D'Aurora/RDD, Ed Svastits/GNV

## Modification Notes:

### Changes to February 9, 2000 Revision:

1. Change the description of the QAQCType field (Field No. 6) to clarify how diluted samples should be reported.
2. Change the description of the LRType field (Field No. 7) to allow for multiple dilutions, re-analyses, and confirmation sample analyses. Also change the example values to reflect this change.
3. Change the description of the AnalysisMethod field (Field No. 10) to correct grammatical error.
4. Minor typographical/grammatical changes in the descriptions of the ExtractDate and ExtractTime fields (Field Nos. 15 and 16).
5. Change requirement of the LabLotCtlNum field (Field No. 20) from Required to Conditional. If there is no preparation, then the value in this field should be blank.
6. Change data type of the Result field (Field No. 24) from Number to Text, length of 10. Clarify the requirement of a text value in the field description.
7. Change the description of the MDL field (Field No. 28) to clarify the contents of the field.
8. Change the description for the UpperControlLimit and LowerControlLimit fields (Field Nos. 35 and 36) to explain when a value is required in those fields.
9. Change the description of the MDLAdjusted field (Field No. 39) to clarify the contents of the field.
10. Change the requirement of the SampleDescription field (Field No. 41) from Required to Conditional. Lab QC samples (method blanks, blank spike, blank spike duplicates) do not appear on the COC.
11. Change the description of the CalRefID field (Field No. 47) to clarify the contents of the field.

| EDD Specification Table | | | | | |
|---|---|---|---|---|---|
| **Field Number** | **Field Name** | **Data Type** | **Data Length** | **Rqmt** | **Description and Comments** |
| 1 | VersionCode | text | 15 | R | Code identifying the version of the EDD deliverable. |
| 2 | LabName | text | 10 | R | Identification code for the laboratory performing the work. This value is used to distinguish among different facilities. |
| 3 | SDG | text | 8 | R | Sample delivery group designation. Always populated for all samples, including QC. |
| 4 | FieldID | text | 13 | R | Client sample ID as appears on COC with optional lab-assigned suffixes and/or prefixes to make it unique. If the sample identifier on the COC and the prefix/suffix is greater than 13 characters, abbreviate the value but make it unique. For laboratory QC samples (i.e., method blanks, lab control samples), use a unique lab sample identifier. |
| 5 | NativeID | text | 13 | R | Client sample ID, exactly as on the COC. No prefix or suffix allowed. Used to identify the native sample from which other samples are derived (e.g., QAQCType = "LR", "MS", or "SD"). For laboratory QC samples (i.e., method blanks, lab control samples), use a unique lab sample identifier. For lab blank spike (and blank spike duplicate) samples, use the FieldID value that was assigned to the associated method blank. |

| EDD Specification Table | | | | | |
|---|---|---|---|---|---|
| **Field Number** | **Field Name** | **Data Type** | **Data Length** | **Rqmt** | **Description and Comments** |
| 6 | QAQCType | text | 2 | R | This is the code for the sample type. Any field sample that is not used as lab QC and is not otherwise marked on the COC should have the designation of "N" (normal field sample). No suffix allowed (i.e., do not add numbers as suffixes to the QAQCType values as is called for in the ERPIMS guidelines).<br>Note that if all analyses for a given sample are diluted, then the first dilution should be designated as the normal sample. If more dilutions are required, then the next dilution should be designated as the first true dilution with a QAQCType value of "LR" and a LRType value of "DL" (see LRType, below). |
| 7 | LRType | text | 3 | C | This is the code for laboratory replicate sample type. Values are:<br>blank (if QAQCType value is not "LR"),<br>"DL" (dilution),<br>"RE" (re-analysis),<br>"D" (inorganic duplicate),<br>"CF" (confirmation).<br>For multiple dilutions or re-analyses of the same sample, append the replicate number after the LRType value (i.e., "RE", "RE2", "RE3", etc.). |
| 8 | Matrix | text | 5 | R | Sample matrix code. Valid values are as follows: "AIR", "WATER", "SOIL", unless otherwise provided by the project data manager and marked on the COC. The use of "liquid", "solid", etc. for lab QC is not allowed. |
| 9 | LabSampleID | text | 20 | R | Laboratory sample ID. Prefix or suffix is allowed. This is where dilutions or re-extractions are noted. Ex: "D97-11111RE" is acceptable. |
| 10 | AnalysisMethod | text | 20 | R | Analysis method code. This is the identifier of the analytical method that was performed on the sample. Example: SW8260A. Generic names such as "EPA" should not be used. |

| EDD Specification Table | | | | | |
|---|---|---|---|---|---|
| **Field Number** | **Field Name** | **Data Type** | **Data Length** | **Rqmt** | **Description and Comments** |
| 11 | ExtractionMethod | text | 20 | R | Preparation method code. A value in this field is required. If the preparation is described in the method, use "METHOD". If there is no separate preparation required, use "NONE". Note that Total and Dissolved metal analyses are differentiated by the value in this column. Note that Total, TCLP, and SPLP analyses are now differentiated by the value in the LeachMethod column (see below). |
| 12 | SampleDate | date | | C | Date of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy |
| 13 | SampleTime | time | | C | Time of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. 24-hour format: hh:mm |
| 14 | ReceiveDate | date | | C | Date of sample receipt in the lab. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy |
| 15 | ExtractDate | date | | C | Date of sample preparation (extraction or digestion). Value is required if the ExtractionMethod field value is other than "NONE". Format: mm/dd/yyyy |
| 16 | ExtractTime | time | | C | Time of sample preparation. Value is required if the ExtractionMethod field value is other than "NONE". 24-hour format: hh:mm |
| 17 | AnalysisDate | date | | R | Date of sample analysis. Value is required for all records. Format: mm/dd/yyyy |
| 18 | AnalysisTime | time | | R | Time of sample analysis. Value is required for all records. 24-hour format: hh:mm |
| 19 | PercentSolids | number | | R | Percent solids within the sample. Should be zero for water samples. |

| EDD Specification Table | | | | | |
|---|---|---|---|---|---|
| **Field Number** | **Field Name** | **Data Type** | **Data Length** | **Rqmt** | **Description and Comments** |
| 20 | LabLotCtlNum | text | 10 | C | Identifier of an autonomous group of environmental samples and associated QC samples **prepared** together. For example, its value can be a digestion or extraction batch ID. If there is no separate extraction or preparation performed, leave this field blank. |
| 21 | CAS | text | 20 | C | CAS number of analyte, if available. |
| 22 | ParamID | text | 12 | R | Parameter identifier code for the parameter listed in the Analyte field. |
| 23 | Analyte | text | 60 | R | Name of analyte, chemical name. |
| 24 | Result | text | 10 | R | Result of the analysis. Surrogate analytes will be reported in units of percent. All others will be reported in sample concentration units. If undetected, report the adjusted MDL or adjusted RL, depending on the project. (Reported as a text field to preserve significant figures.) |
| 25 | ExpectedValue | number | | C | "100" for surrogates; "0" (zero) for blanks; spike level plus parent result for LCS, and MS/MSD; parent value for lab duplicate; etc. |
| 26 | Units | text | 10 | R | Units of measure used in the analysis. Report "PERCENT" for surrogate analytes and concentration units for all others. |
| 27 | Dilution | number | | R | Total dilution reported in the analysis. Default value should be 1 (one). This value should reflect changes to sample preparation amounts as defined by the method (e.g., less sample used for standard VOC analysis). |
| 28 | MDL | number | | C | Minimum detection limit adjusted for preparation and dilution. Note that this value may be the method detection limit or the instrument detection limit, depending on the method and the project requirements. This value is **not** adjusted for percent moisture. |
| 29 | RL | number | | C | Reporting limit adjusted for preparation and dilution. Value is **not** adjusted for percent moisture. Equivalent to PQL. |

| EDD Specification Table | | | | | |
|---|---|---|---|---|---|
| **Field Number** | **Field Name** | **Data Type** | **Data Length** | **Rqmt** | **Description and Comments** |
| 30 | LabQualifier | text | 6 | R | Lab qualifier for the results, as reported on the hard copy. Use "=" as first (or only) qualifier value for detected results. |
| 31 | Surrogate | text | 1 | R | Is the chemical a surrogate? Report "Y" for yes or "N" for no. |
| 32 | Comments | text | 240 | O | Comment field |
| 33 | ParValUncert | text | 16 | C | Radiological parameter value uncertainty. |
| 34 | Recovery | number | | C | Percent recovery for MS, SD, LCS, and surrogate compounds. |
| 35 | LowerControlLimit | number | | C | Lower control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34). |
| 36 | UpperControlLimit | number | | C | Upper control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34). |
| 37 | Basis | text | 1 | R | Weight basis for soil (or solid) sample analysis. Use "D" for dry-weight basis, "W" for wet-weight basis, or "X" if not applicable. |
| 38 | ConcQual | text | 1 | R | Concentration qualifier. Use "=" for detects, "J" for estimated value (value between detection limit and reporting limit), "U" for undetected result, or "E" for exceeded result. |
| 39 | MDLAdjusted | number | | C | Minimum detection limit adjusted for preparation, dilution **and percent moisture**. See the description of the MDL field (Field No. 28) for an explanation of the contents of this field. |
| 40 | RLAdjusted | number | | C | Reporting limit adjusted for preparation, dilution **and percent moisture**. Equivalent to PQL |
| 41 | SampleDescription | text | 20 | C | Full sample identifier value as it appears on the COC. In some cases, this may be the name of the sampling location instead of the sample. Required for all samples that are either collected in the field and specified on the COC, or derived from samples that are collected in the field and specified on the COC. |

| EDD Specification Table | | | | | |
|---|---|---|---|---|---|
| **Field Number** | **Field Name** | **Data Type** | **Data Length** | **Rqmt** | **Description and Comments** |
| 42 | LeachMethod | text | 20 | R | Analytical method used for leaching the sample. This applies to TCLP, SPLP, or other leaching or pre-extraction leaching procedures. Use "NONE" if the sample was not leached. |
| 43 | LeachDate | date | | C | Date that the leaching method was performed (start date for multi-date leaching procedures). Value is required if the LeachMethod field value is other then "NONE". Format: mm/dd/yyyy. |
| 44 | LeachTime | time | | C | Time that the leaching procedure started. Value is required if the LeachMethod field value is other then "NONE". 24-hour format: hh:mm. |
| 45 | LeachLot | text | 20 | C | Identifier of an autonomous group of environmental samples and associated QC samples **leached** at the same time. If the sample was not leached, leave this field blank. |
| 46 | AnalysisLot | text | 20 | R | Identifier of an autonomous group of environmental samples and associated QC samples **analyzed** together. A value in this field is mandatory (i.e., it should not be blank). |
| 47 | CalRefID | text | 20 | C | Identifier of a group of environmental and QC samples linked by a common set of calibration records. All results with the same CalRefID value will have had the same initial calibration run. |

Each row is uniquely identified by the values in the following fields:

- FieldID
- AnalysisMethod
- ExtractionMethod
- LeachMethod
- ParamID

If an analytical sample must be diluted or reanalyzed and reported in addition to the original analytical sample, the diluted or reanalyzed sample should have a FieldID value that is different that that of the original sample. This can be accomplished through the addition of a suffix to the original FieldID that establishes a new and unique FieldID for the associated records.

## Example Valid Values

The project data manager will provide the laboratory with a list of valid values that the laboratory will use in constructing the EDD. Listed below are some example valid values.

| Field Name | Valid Value | Meaning |
|---|---|---|
| VersionCode | 4.00AFCEE3 | Format 4.00, AFCEE data values. LabQualifier field contains the laboratory qualifier values defined in the AFCEE QAPP, version 3.0. |
| VersionCode | 4.00EPACLP | Format 4.00, EPA data values. LabQualifier field contains the standard EPA CLP lab qualifiers. |
| QAQCType | N | Normal, environmental sample |
| QAQCType | LB | Laboratory method blank |
| QAQCType | MS | Laboratory matrix spike sample |
| QAQCType | SD | Laboratory matrix spike duplicate |
| QAQCType | LR | Laboratory replicate (dilution, re-analysis, duplicate) |
| QAQCType | BS | Laboratory method blank spike |
| QAQCType | BD | Laboratory method blank spike duplicate |
| LRType | DL | First dilution sample |
| LRType | DL2 | Second dilution sample |
| LRType | DL3 | Third dilution sample |

| Field Name | Valid Value | Meaning |
|---|---|---|
| LRType | RE | First re-analysis/re-extraction sample |
| LRType | RE2 | Second re-analysis/re-extraction sample |
| LRType | RE3 | Third re-analysis/re-extraction sample |
| LRType | D | Inorganic duplicate sample |
| LRType | CF | First confirmation analysis sample |
| LRType | CF2 | Second confirmation analysis sample |
| LRType | CF3 | Third confirmation analysis sample |
| AnalysisMethod | SW8260A | Volatiles by method 8260A in EPA SW846. |
| AnalysisMethod | SW8270 | Semivolatiles by method 8270 in EPA SW846. |
| AnalysisMethod | SW6010 | ICP metals by method 6010 in EPA SW846. |
| AnalysisMethod | SW7060 | GFAA Arsenic by method 7060 in EPA SW846. |
| ExtractionMethod | FLDFLT | Field filtration for dissolved metals analysis |
| ExtractionMethod | C3050 | CLP-modified SW3050 acid digestion for metals analysis in soil samples. |
| ExtractionMethod | SW1311 | TCLP extraction |
| ExtractionMethod | DISWAT | Distilled water extraction for analytes in soil samples. |
| ExtractionMethod | SW3510 | Separatory funnel extraction |
| ExtractionMethod | SW3540 | Soxhlet extraction |
| ExtractionMethod | TOTAL | Digestion of unfiltered waters for total metals analysis |

| Field Name | Valid Value | Meaning |
|---|---|---|
| ParamID | ACE | Acetone |
| ParamID | AS | Arsenic |
| ParamID | BHCGAMMA | gamma-BHC (Lindane) |
| ParamID | BZ | Benzene |
| ParamID | CDS | Carbon disulfide |
| ParamID | PB | Lead |
| ParamID | PHENOL | Phenol |
| ParamID | SE | Selenium |
| ParamID | TCE | Trichloroethene |

APPENDIX E

# Qualifier Flags and Two-Digit Code Definitions for Comment Field

## Attachment E - Qualifier Flags and Two Digit Code Definitions for Comment Field

The following flags are used in the Data Review and Validation Guidelines and the *USEPA CLP National Functional Guidelines* to qualify the data.

| Flag | Meaning | Explanation |
|---|---|---|
| U | Undetected | Analyte was analyzed for but not detected above the method detection limit. |
| UJ | Detection Limit Estimated | Analyte was analyzed for, and qualified as not detected. The result is estimated. |
| J | Estimated | The analyte was present, but the reported value may not be accurate or precise. |
| R | Rejected | The data are unusable. (NOTE: Analyte/compound may or may not be present.) |

During DV, the validator will apply a two-letter code to the right of each project qualifier applied. This code represents why the compound/element was flagged. The data entry personnel will enter this code into the comment field of the database.

| Code | Definition |
|---|---|
| TN | Tune |
| BS | Blank Spike/LCS |
| IS | Internal Standard |
| MS | Matrix Spike and/or Matrix Spike Duplicate Recovery |
| MD | Matrix Spike/Matrix Spike Duplicate Precision |
| 2S | Second Source |
| SD | Serial Dilution |
| SS | Spiked Surrogate |
| LR | Analyte present above linear (or calibration) range |
| IC | Initial Calibration |
| CC | Continuing Calibration Verification |
| PD | Pesticide Degradation |
| LD | Lab Duplicate |
| 2C | Second Column (Confirmation) |
| HT | Holding Time |
| PS | Post Spike |
| BL | Blank |
| RE | Re-extraction |
| DL | Dilution |
| IB | In Between |
| FD | Field Duplicate |
| OT | Other |

APPENDIX F

# Final Responses to Comments on Final Remedial Investigation/Feasibility Study Work Plan for AOC R, The Former Naval Ammunition Storage Detachment (NASD), Vieques Island, Puerto Rico

MEMORANDUM

# Final Response to Comments on *Final Remedial Investigation/Feasibility Study Work Plan for AOC R, The Former Naval Ammunition Storage Detachment (NASD), Vieques Island, Puerto Rico*

TO: CERCLA Technical Subcommittee

COPIES: CH2M HILL

FROM: NAVFAC, Atlantic

DATE: August 25, 2005

This memorandum compiles the Navy's responses to all of the comments received on the *Final Remedial Investigation/Feasibility Study Work Plan for AOC R, The Former Naval Ammunition Storage Detachment (NASD), Vieques Island, Puerto Rico* (CH2M HILL, January 2005). For each reviewing agency, the comments have been reproduced, followed by the response in bold type. Please note that where applicable, the responses refer to pages in the original document, not the revised text with comments incorporated.

The following key screening table and figures, modified in accordance with the comments and response to comments, have been attached to this memorandum:

Attachment 1: Screening comparison table (current ECO, PRG-R, PRG-I, and leachability criteria)

Attachment 2: Revised Figure 2-5 (Surface Soil Detections Above Screening Criteria)

Attachment 3: Revised Figure 3-1 (Conceptual Site Model)

Attachment 4: Revised Figure 4-1 (Proposed Monitoring Well and Sampling Locations). Note that all monitoring well and sample locations are shown on one figure because full TCL/TAL and explosives analyses have been concurred upon for all samples collected as part of this Work Plan.

**USEPA (including comments from NOAA)**

1. The copy of the document EPA received indicated that the RI/FS work plan was a final document. The RI/FS work plan still a draft document, please correct.

   **Navy Response:**
   **Once the Response to Comments are concurred upon and approved by EPA, the Work Plan will be revised in accordance with the approved Response to Comments and the revised Work Plan will then be submitted as Final.**

2. Executive Summary, page iii: In the fourth paragraph, the text suggests that the groundwater will be analyzed for explosives. Please clarify if this includes perchlorate.

**Navy Response:**
**No perchlorate analyses will be conducted during the initial RI activities. The explosives analysis will be conducted using SW846 Method 8330. This analytical suite is adequate in evaluating the potential presence of explosive-related constituents. If explosives are detected using Method 8330 or other information is identified that suggests perchlorate may be present, the need for re-sampling for perchlorate analysis will be evaluated.**

3. Executive Summary, page iii: Please note that due to the proximity of this site to an ephemeral stream we are recommending that surface soil samples be collected from the top 0-24" to take into account the potential exposure to the land crab.

   **Navy Response:**
   **The Navy concurs with this recommendation, based on the surface soil sample depth selection criteria document distributed by EPA during the March 29, 2005 Technical Subcommittee Meeting (see Final Meeting Minutes) and the presence of an ephemeral stream at the site.**

4. Executive summary: a) For clarity, please refer to "continuous sampling' only when samples will be logged at all horizons. It is used here in reference to both this approach and to sampling every 5 feet. b) The screened intervals for all wells need to be logged continuously.

   **Navy Response:**
   **a) The Navy concurs with this comment. The term "continuous sampling" or "continuous logging" will be used when the entire vertical profile is sampled or logged. The term "interval sampling" or "interval logging" will be used when only discrete intervals within the entire vertical profile are sampled or logged. Based on this, the Executive Summary, page iv, first paragraph, second sentence will be revised to read: "The lithology of the soils will be characterized via continuous logging at three well locations and interval logging every 5 feet at the remaining well locations by split spoon down to the water table (approximately 45 ft). The split-spooned samples will be screened with an organic vapor meter (OVM) during advancement of the soil borings for monitoring well installation."**

   **b) Three of the monitoring wells (MW-1, MW-3, and MW-6) have been chosen to have rock coring accomplished if bedrock is encountered prior to the water table. These wells are spread out across the site from north to south and will give a good cross-sectional interpretation of the subsurface geology. In addition to the importance of subsurface geological characterization, it is important to determine where the water table is located during the installation of the monitoring wells, in order to properly place the screen interval. Rock coring requires water to be added to the boring, making it difficult to determine where the water table is located. Video logging will be conducted across the intervals to be screened for the wells that are not cored. The text will be revised to clarify the above information.**

5. Section 2, Site Background and Physical Setting, page 2-1: The opening paragraph should clearly indicate that this document is addressing only one site, rather than two.

**Navy Response:**
**Section 2, Site Background and Physical Setting, page 2-1, first sentence will be revised to read: "This section summarizes the available information on the Former NASD site (i.e., AOC R) to be investigated further under this RI/FS Work Plan."**

6. Section 2.3, Previous Investigations, page 2-2: Based upon our March 7th -8th meeting, it may not be appropriate to use the UTL for inorganics in background, as sampling conducted may not meet appropriate statistical requirements. As indicated in comments to the technical meeting notes, it may be more appropriate to screen against the range of background data, or the lowest value collected for each contaminant.

**Navy Response:**
**Section 2.3 is a discussion of previous investigations and how the data were presented in the Background section. However, based on the discussions made during the March 7, 2005 Technical Subcommittee regarding comparisons of site-specific data to background data, a new Section 5.3 will be added to the AOC R Work Plan (between the current Sections 5.3 and 5.4) entitled "Comparison of Site-Specific Data to Background Data." This new subsection will contain the following text, which is a modified excerpt from the Final Meeting Minutes from the March 7, 2005 Technical Subcommittee Meeting:**

**"The 95% UTL levels will be used when comparing site-specific data points to the background inorganic concentrations. However, when performing population-to-population comparisons, appropriateness (or inappropriateness) of EPA's *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (EPA, September 2002) will be evaluated by a statistician and, if concurrence that the guidance is not applicable when one or both datasets (i.e., site and background) are not randomly selected, the Navy will propose an alternate approach for performing the background comparison, which may be based on a non-statistical, professional judgment process, or other more suitable statistical procedure."**

**In addition, text will be included in the new subsection that explains how background inorganics data are used, in accordance with Subcommittee discussions. That is, background inorganics data will be used help determine the nature and extent of contamination, but will not be used to screen out site-specific data from risk assessments. Risk assessments will be completed on all data that exceed PRGs, including those constituents that are within the range of background concentrations. Once the risk assessments are completed, the background inorganics data will be compared to site-specific data in order to make risk management recommendations.**

7. Section 2.3.2.4, Surface Soil Results, page 2-7: As previously indicated, surface soil data should be screened against values protective of ecological receptors and should be discussed.

**Navy Response:**
**The surface soil samples that were collected during the PA/SI in November 2000 were re-screened against the most current ECO, PRG-R, PRG-I, and leachability criteria for soil. The results of this screening are included as Attachment 1 of this response document. The results will be discussed in the revised text of the Work Plan and are included on a revised Figure 2-5 (Attachment 2).**

8. Table 2-1: In the revision of the document, please consider using a lighter shade of gray for the table. The current shade is difficult to read.

   **Navy Response:**
   **The shading of Table 2-1 will be modified so the table is more legible.**

9. Section 2.3.2.6, SVOCs, page 2-8: The last sentence in this section indicates that "VOCs, pesticides, and PCBs either were not detected or were detected at concentrations below applicable screening criteria." However, as noted above, as data were not screened against values protective of ecological receptors, this statement may not be accurate. Further, it should be noted whether detection levels are below screening values. This may need to be addressed in the uncertainty section of the screening level ecological risk assessment.

   In addition, the text of the document again uses language that says contaminants were either not detected or detected below screening criteria. This is not appropriate. Indicate all anthropogenic compounds which were detected, and note which compounds or classes were non-detect. All detections should also be included on a figure, flagging those above criteria. This comment has been made on every work plan and report and it is time to change this practice.

   **Navy Response:**
   **The primary goal of the RI is to focus the discussion and evaluation on constituents that represent potential risks. The Subcommittee concurred during the June 21, 2005 meeting that everything detected will be noted (and included in "detects" table(s) in the text), but that the discussion will focus on those constituents that exceed PRGs, ecological screening criteria, and background levels. The text will be revised accordingly, and in accordance with the response to Comment 7 above.**

10. Figure 2-5, AOC R Surface Soil Detections Above Screening Criteria and Background: This figure should be revised to show exceedances of ecological screening values. Further, based on recent discussions concerning use of background data, data exceeding background values may also be revised.

    **Navy Response:**
    **Figure 2-5 has been revised to show exceedances of ecological screening criteria. The revised Figure 2-5 is included with these response to comments as Attachment 2.**

11. Section 3.1.2, Soil, page 3-1: Please include EPA soil screening values (http://www.epa.gov/ecotox/ecossl/). Further, although the two references for Efroymson are correct, please add the following document which contains a table (Table 4) which compares the benchmarks for three types of organisms (wildlife, plants, and soil invertebrates) and uses the lowest available preliminary remedial goal (PRG). The reference is as follows: Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones. 1997. **Preliminary Remediation Goals for Ecological Endpoints**, Oak Ridge National Laboratory, Oak Ridge, TN. 50 pp (ES/ER/TM-162/R2. http://www.esd.ornl.gov/programs/ecorisk/contaminated_sites.html#reports

**Navy Response:**
**EPA ecological soil screening values will be considered when developing the set of soil screening values to be used in the ERA, as will other appropriate sources from the literature.**

**The ecological soil screening values cited in this section are from the Oak Ridge National Laboratory, which has identified soil screening values specific to soil invertebrates and microbial processes (Efroymson et al., 1997a), and terrestrial plants (Efroymson et al., 1997b). The values from these references will be considered when developing the set of ecological soil screening values to be used in the ERA. However, the ORNL PRG document is not necessarily relevant because it also includes values that are based upon back-calculated food web exposures. Such values may not be applicable to AOC R because they may be based upon inappropriate receptor species and/or may be developed using parameter values (such as body weights) that may be geographically inappropriate to AOC R. It is noted that toxicity values that are used to derive threshold values in the ORNL PRG document will be evaluated for applicability. Exposures via food webs will be evaluated separately from direct exposures of lower trophic level receptors (e.g., plants and soil invertebrates) by modeling exposures, and developing ingestion-based screening values, for receptors that are appropriate to the habitats and exposure pathways present on AOC R. ORNL ingestion-based screening values (Sample et al. 1996), which are used in the ORNL PRG document to develop the wildlife-based values, will be considered when developing the set of ingestion-based screening values to be used in the ERA, as will other applicable sources from the literature. The food web exposure calculations will be included in the RI Report.**

12. Section 3.2, Conceptual Site Model, page 3-2: As discussed during the October technical meeting, and as identified in Figure 2-2 (orange line), there is an ephemeral stream west of the site which may be impacted by site activities and needs to be assessed. This is also noted in the response to PREQB comment # 49, which indicates that the vegetated area to the west of the site is an ephemeral stream. While it may be true that there are no surface water bodies on site, there may be surface water bodies off site which are impacted by AOC R.

    **Navy Response:**
    **As agreed upon during the May 5, 2005 site visit to AOC R by the Technical Subcommittee, the study area of AOC R will be expanded to include the ephemeral stream on the west side. Therefore, the presence of this stream and the potential migration and exposure pathways have been added to the conceptual site model. The revised conceptual site model is attached to these response to comments as Attachment 3. In addition, sampling of the ephemeral stream sediment (and surface water, if present) will be conducted in accordance with the final Meeting Minutes for the May 5, 2005 site visit conducted by the Technical Subcommittee. A revised Figure 4-1 showing the potential surface water and sediment sampling locations (actual locations will be based on field conditions at the time of sampling) has been included with these response to comments as Attachment 4.**

13. Section 3.3, Preliminary Remedial Action Objectives and Goals, page 3-2: Please refer to the ecological risk assessment as a screening level ecological risk assessment (SLERA)

rather than a "baseline risk assessment." It appears contradictory to discuss AWQC for the protection of ecological receptors if surface water is not a media of concern.

**Navy Response:**
**The ecological risk assessment will be conducted through Step 3a of the ERA process, which includes a screening ERA (Steps 1 and 2) and the first step of the baseline ERA (Step 3). The text will be modified to clearly indicate this. The AWQC referred to in Section 3.3 are in regards to human health exposure, and not aquatic organism exposure. The text will be modified to clarify this, and will include the Puerto Rico Water Quality Criteria to evaluate potential impacts to ecological receptors. Because surface water has been observed to temporarily pond and flow within the stream near AOC R, the aquatic exposure pathway will be considered potentially complete as a conservative assumption. Text will be added to the CSM discussion in Section 3.2 to clarify the potential aquatic exposure pathway.**

14. Figure 3-1, Conceptual Site Model for AOC R: Former Construction Staging Area and AST: Please note that subsurface soil is usually not considered a pathway of concern for ecological receptors (as noted in Section 5.3.1.1 Screening Level Problem Formulation, contaminant fate and transport, page 5-5). A surface pathway and a groundwater pathway to surface water and sediment should be added as appropriate.

    **Navy Response:**
    **The CSM has been modified to remove the subsurface soil exposure pathway to terrestrial plants and animals, and the overland runoff pathway has been added (see Attachment 3). A groundwater pathway to surface water and sediment does not exist at this site, based upon available data and observations made during the May 5, 2005 site visit; therefore, this pathway is incomplete. However, if data collected during the RI (i.e., water-level and direction of flow data from wells) suggest the groundwater-to-surface water/sediment pathway is complete, it will be added to the CSM and evaluated accordingly.**

15. Table 4-1, Previously Conducted Sampling at AOC R as Reported in Expanded PA/SI Report: Please note that ecological values were not used for screening and therefore the actual list of COCs may be underestimated.

    **Navy Response:**
    **Screening of the PA/SI data against ecological criteria (as shown in Attachment 1) did not result in a change to the constituents identified in Table 4-1. However, for clarity the text in Table 4-1 associated with the PA/SI will be revised to read "Several metals and SVOCs detected in surface soil above human health and/or ecological screening criteria."**

16. Section 4.1, Data Quality Objectives, page 4-2: The second to last sentence in the first paragraph indicates ". . . this work plan includes a sampling plan to further investigate the extent of the PAHs and metals." As a risk assessment has not been conducted, it may not be appropriate at this time to narrow the scope of analysis. It is recommended that a full TAL/TCL analysis be conducted.

    **Navy Response:**
    **Tables 4-3 and 4-4 show that the full TCL (plus explosives) suite is proposed for the soil and groundwater samples to be collected. The text will be revised to make the analytical protocol consistent with Tables 4-3 and 4-4. In addition, the surface water**

**and sediment samples will be subject to the same analytical protocol as the soil and groundwater samples.**

17. Section 4.3.1, Munitions Identification, Removal and Avoidance Survey, page 4-3: The text references an MEC identification Form 2-1 in Appendix C. Is this meant to reference for Form 2-5 in Appendix G? The nature of the MEC should be described in the report, including all information as to what chemical components would have been included in the item. This will document that soil sampling targeted all likely contaminants.

    **Navy Response:**
    **An MEC Information Form 2-1 will be added to Appendix G. Section 4.3.1 Munitions Identification, Removal and Avoidance Survey, first paragraph, second sentence will be edited to read: "An MEC Information Form 2-1 (Appendix G) will be filled out for each munitions item identified." Note: Appendix letters may be adjusted after edits are incorporated.**

    **The nature of the MEC will be discussed in the RI Report. All samples collected in the vicinity of the MEC during the RI will be analyzed for explosives and inorganics (as will all samples collected during the RI).**

18. Section 4.3.2, Monitoring Well Installation, page 4-4: Wells MW-3 and MW-4 should be installed right next to the pad rather than 100 feet away. This will target the area where release is most likely to have occurred. MW-7 should be moved approximately 50 feet south and 25 ft west, placing it just at the northern edge of where existing samples were collected. The location of MW-1 was altered during the May 5, 2005 site visit so as to be located further upgradient. This should be reflected on the revised work plan.

    **Navy Response:**
    **The monitoring well locations will be moved as requested. Section 4.3.2 Monitoring Well Installation, third bullet will be edited to read: "Monitoring wells NDARMW03 and NDARMW04 will be located within approximately 10 feet of the concrete pad along Highway 200 to provide data downgradient of the concrete pad." Also, the sixth bullet will be edited to read: "Monitoring well NDARMW07 will be installed within 10 feet, in the downgradient direction, of where soil samples were collected during the PA/SI." The first bullet will be edited to read: "Monitoring well NDARMW01 will be installed upgradient of the area for use in site-specific background comparisons." A revised Figure 4-1 showing the modified monitoring well locations has been included as Attachment 4 to these response to comments.**

19. Section 4.3.2, Monitoring Well Installation, page 4-5: As noted in the comment on the executive summary, all wells should be continuously logged. If in rock, each one should be cored (or logged by a similarly robust method), not just 3 of the wells.

    **Navy Response:**
    **Please see response to Comment 4.**

20. Section 4.3.2.1, Groundwater Sampling and Analysis, page 4-5: The intended data use for the TDS analyses of groundwater is unclear. Please give the rationale or consider omitting the analyses. Also, indicate that samples will not be collected until 2 weeks after installation and development.

**Navy Response:**
**TDS analyses were proposed to develop an understanding of the salinity of the groundwater, to assist in determining its potability. This will be clarified in the text. In addition, the first sentence of the second paragraph under Section 4.3.2.1 will be revised to read: "A round of water-level measurements will be collected from all monitoring wells a minimum of 2 weeks after well development, just prior to sampling."**

21. Tables 4-3 and 4-4: Please clarify that thallium will also be analyzed by graphite furnace atomic absorption spectroscopy.

**Navy Response:**
**In accordance with the final Meeting Minutes from the March 8, 2005 Technical Subcommittee Meeting, thallium will be analyzed using SW-846 Method 7841 in order to achieve reporting limits at or below the adjusted PRG, in addition to thallium analysis as part of the standard TAL. Analyzing for thallium using both methods will provide for comparison of results and consistency in the data use when conducting statistical analyses. Tables 4-3 and 4-4 will be revised to include the additional thallium analytical method.**

22. Section 4.3.2.3, Surface and Subsurface Soil Sampling and Analysis, page 4-7: As this site is adjacent to an ephemeral stream, it is our recommendation that surface soil samples encompass the top 0-24". Further, surface soil samples should be collected from any surface runoff pathways. Sediment and surface water samples should be collected as necessary.

**Navy Response:**
**Please see response to Comments 3 and 12. In addition, during the reconnaissance performed during the MEC clearance and RI fieldwork, potential surface runoff pathways from identified debris areas to the ephemeral streams, if observable, will be sampled in accordance with the contingency sampling agreed upon during the March 29, 2005 Technical Subcommittee Meeting and documented in the final Meeting Minutes.**

23. As determined during the May 5, 2005 site visit, three sediments/soil samples in the ephemeral stream will be added to the work plan. These locations were noted in the field and included sampling locations downstream of the ordnance item, right at the ordnance location, and upstream of the ordnance. It was further agreed that if standing water pools were present at or near these locations at the time of sampling, the water will also be sampled. Please modify Section 4.3, Field Investigation, to include discussion of the sediment and potential surface water sampling and analysis.

**Navy Response:**
**The Navy concurs that the above is what was concurred upon during the May 5, 2005 site visit by the Technical Subcommittee. The text of the Work Plan will be revised to add a subsection on sampling within the ephemeral stream. Revised Figure 4-1, showing the potential ephemeral stream sampling locations, is included with these response to comments as Attachment 4. Please note that if, during the sampling event, the streambed is submerged, the solid sample collected from the streambed will be designated "sediment" and will be collected from 0 to 6 inches. If, during the sampling event, the streambed is not submerged (i.e., unsaturated), the solid sample**

**collected from the streambed will be designated "soil" and will be collected from 0 to 24 inches in accordance with the surface soil sampling protocol at AOC R.**

24. There are two sections numbered 4.3 in the work plan. There is a Section 4.3, Field Investigation, page 4-3, and another Section 4.3, Sampling and Equipment Decontamination, page 4-8. Please correct. Also, correct the Table of Content.

    **Navy Response:**
    **The section numbering will be corrected in the text and the Table of Contents.**

25. Section 4.3.1, Electronic Deliverable File Format, page 4-8: Requests have been made in the past to coordinate electronic formats used by CH2M Hill with those being implemented at EPA. This effort has not moved forward and should be pursued to transition work on Vieques into EPA's formats.

    **Navy Response:**
    **As documented in the draft Meeting Minutes from the June 22, 2005 Technical Subcommittee Meeting, the Navy environmental database is Navy-wide rather than region- or site-specific. Therefore, its format is established by a Navy standard. It was concurred during the meeting that the EPA Region 2 database will be re-evaluated to determine which of the Region 2 fields are designated as "required" and if the Navy database can be "dumped" into the EPA Region 2 format, leaving blanks for fields that are not stored. In addition, the Navy will determine if there is a Navy database specification that can be shared with EPA.**

26. Figure 4-2, AOC R Surface Soil Sample Locations: The ephemeral stream should be clearly identified in this figure. It is indicated in Figure 2-4 that there is an MEC area to the west of the site. Additional surface soil samples will be collected from this area (Figure 4-2). These sample location should be numbered as appropriate. As there is an ephemeral stream in this area, surface pathways to the stream from this area should be sampled, as appropriate.

    Also, No soil samples are proposed to be collected and analyzed for explosives in the areas where MEC items were found. According to the Figure, only two samples are proposed to be collected and analyzed for explosives near the light vehicle maintenance area. Samples for explosives and perchlorate analyses should be added in these MEC areas.

    **Navy Response:**
    **The approximate ephemeral stream boundaries and the proposed sample locations have been added to revised Figure 4-1 (Attachment 4). An incorrect surface soil sample symbol was used for the samples around the MEC items in the original Figure 4-2.**

27. Figures 4-2 and 4-3: The keys on the figures do not match the text or Table 4-4. It is presumed that the text and table is correct and the figure needs to be amended. The clarification is important in that it is not clear what analyses are intended.

    **Navy Response:**
    **The text, tables, and figures will be revised to reflect the total number, locations, and analytical protocol consistently and in accordance with the applicable response to comments above.**

28. Section 5.2, Human Health Risk Assessment Approach, page 5-1: Please delete the reference to RAGs Volume II, *Environmental Evaluation Manual*, as this has been replaced by *Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments* (ERAGS), as noted in Section 5.3 Ecological Risk Assessment Approach, and included in the References (page 9-2).

    **Navy Response:**
    **The reference will be removed.**

29. Section 5.2.3, Toxicity Assessment, page 5-4: Please revise this section to more accurately reflect the toxicity database hierarchy established in the December 2003 "Human Health Toxicity Values in Superfund Risk Assessments" (OSWER Directive 9285.7-53).

    **Navy Response:**
    **The toxicity criteria will be selected from the EPA databases in accordance with the following hierarchy: (1) IRIS, (2) provisional values obtained from the EPA Region 2 human health risk assessor, and then (3) HEAST values. The text will be revised to reflect this.**

30. Section 5.3.1.2, Screening-Level Ecological Effects Evaluation, page 5-5: The soil ecotoxicity values described here should match those discussed in Section 3.1.2. Soil (page 3-1) and include a reference to EPA's soil screening values.

    **Navy Response:**
    **The soil ecotoxicity values discussed in this section will be updated to reflect those described in response to Comment 11.**

31. Section 5.3.2.1, Screening Level Exposure Estimates, page 5-6: There is a discussion regarding detected concentrations in surface water and sediment. This discussion should match that in Figure 3-1 Conceptual Site Model . As noted above and in previous discussions, it is our recommendation that any potential impacts to the ephemeral stream are addressed; which may include the collection of sediment and surface water samples.

    **Navy Response:**
    **Please see the response to Comment 12.**

32. Section 5.3.3.1, Step 3a - Refinement of Preliminary Constituents of Concern, page 5-7: The last sentence in the first paragraph is incomplete. Specifically, ". . . HQs near or below . . ." should include a numerical reference.

    **Navy Response**
    **The sentence will be deleted. In addition, the introductory text in Section 5.3.3.1 will be updated to clarify that only a Screening Level ERA is being proposed in this AOC R Work Plan, and that Step 3a is the final screening level step to be conducted under this Work Plan. Baseline risk assessment steps (Steps 3b through 7) described in subsequent sections of the work plan are provided as a general outline of the full ERA process, and would be completely described in a future work plan should a baseline ERA be deemed necessary, based on the results of the Screening Level ERA.**

    a. in the second bullet specify that contaminant concentrations will be compared to background inorganics.

**Navy Response**
**The second bullet will be revised to read: " Inorganics concentrations in surface soils will be compared to surface soil background concentrations."**

b. in the fourth bullet please indicate why only values used by Region 4 will be considered.

**Navy Response:**
**The soil ecotoxicity values in this bullet will be updated to reflect those described in response to Comment 11, and the fifth bullet will be deleted.**

33. Table 5-1, Exposure Factors for Soils, page 5-10:

a. Please revise the Dermal Absorption Factor for the Residential Adult to 0.7 mg/cm$^2$. The reference for this is Exhibit 3-5 in RAGS Part E.

**Navy Response:**
**The comment is a little confusing, as the suggested value is an adherence factor (not an absorption factor) and an order of magnitude lower in the referenced exhibit. The skin soil adherence factor for a residential adult of 0.07 mg/cm$^2$ will be used in the risk assessment, instead of the currently proposed 0.2 mg/cm$^2$, as suggested by the comment. It is important to note that existing RI reports used the more conservative value of 0.2 mg/cm$^2$.**

b. The Particulate Emission Factor presented in the table is the default value based on data for a 0.5 acre property in Minneapolis. Please develop a site-specific PEF value that is more consistent with the size and soil characteristics of AOC R. Please use the Q/C values in Table 3 (page 27) of the "Soil Screening Guidance: Technical Background Document" (May 1996; EPA Publication 9355.4-17A) and select an appropriate comparison city and property size for the calculation of the PEF.

**Navy Response:**
**A site-specific PEF value will be developed using EPA SSL guidance during the RI, and the existing value will be removed from Table 5-1.**

c. It is unclear why exposure times are provided for the non-residential populations but not for the residential adult and child. Please clarify how these ET values will be used.

**Navy Response:**
**The ET values will be removed from the table, as they are not being used for any of the equations.**

34. Table 5-2, Exposure Factors for Groundwater, page 5-11:

a. Please clarify why there is no exposure time value for the industrial worker.

**Navy Response:**
**An exposure time will be added for an industrial worker in the revised Table 5-2. Workers will be assumed to use groundwater from the site to wash hands while at work. Using best professional judgment, workers are conservatively assumed to wash hands 5 to 6 times during an 8 hr workday, resulting in total exposure time of approximately 30 min. Thus the exposure time (ET) of 0.5 hr/day will be used to estimate dermal dose from site groundwater.**

b. Please remove the reference to EPA Region 4 policy in footnote "*".

**Navy Response:**
**The reference will be removed from the revised table.**

35. Section 7, Remedial Investigation/Feasibility Study Report, page 7-2: Please indicate that Section 5.2 should be entitled, "Screening Level Ecological Risk Assessment" rather than "Ecological Risk Characterization."

**Navy Response:**
**Section 5 will be renamed "Human Health and Ecological Risk Assessments." Section 5.2 will be entitled "Ecological Risk Assessment." Section 5.3 will be deleted.**

36. Section 9, Project Management, page 9-1: The section only identifies the Project Manager. The roles and responsibilities for all personnel involved in this particular project should be described. The Master Work Plan describes the overall project management, however, these roles and responsibilities should be defines for each individual project.

**Navy Response:**
**Because this information is not required by CERCLA, and because project personnel and subcontractors may not be known until immediately prior to conducting the project, this section will be eliminated from this and future work plans. Information regarding project personnel and subcontractors will be provided on an as-requested (via e-mail, phone, or letter correspondence) and as-available basis.**

37. An Organization Chart, was not included in the Work Plan. This chart should be included before finalizing the document.

**Navy Response:**
**Please see response to Comment 36.**

38. Appendix C, Screening Criteria: Ecological Soil Screening values should be included in addition to the Region 9 PRGs, along with freshwater sediment and surface water screening values (Persaud, D., J. Jaagumagi and A. Hayton. 1993 Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ministry of Environment and Energy, Toronto. PIBS 1962. 24p.). Also, please revise this table to include the most recent EPA Region 9 PRG values.

**Navy Response:**
**The screening values listed in Appendix C will be updated and included in the revised Work Plan. Ecological screening values for soil (as described in response to Comment 11) will be added, and surface water and sediment will be updated.**
**The human health PRG values will be revised to include October 2004 updates to the Region 9 PRG values. In addition, a copy of the PRG tables containing SSL values will be added to Appendix C. This updated version of screening values for human health and ecological protection will be used for the AOC R RI; if there are additional revisions to the criteria prior to preparation of the RI report, they will be utilized.**

**PREQB**

## I. INTRODUCTION

EQB has reviewed and provides the attached Evaluation of Response to Comments regarding the Draft Remedial Investigation/Feasibility Study Work Plan for Area of Concern (AOC) R.

The Navy provided Responses to the June 2004 EQB Comments to the April 2004 Draft RI/FS Work Plan for AOC I and AOC R. The responses were provided in Appendix F of the Final Remedial Investigation/Feasibility Study Work Plan for AOC R, dated January 2005. The January 2005 Final Work Plan comprises AOC R only. The Draft RI/FS Work Plan presented the proposed RI/FS sampling activities at AOC I and AOC R.

This evaluation summarizes significant issues identified with the Navy's Response to Comments regarding the RI/FS Work Plan.

Please note that this evaluation considers responses to AOC R although the initial draft RI/FS Work Plan comprised AOC I and AOC R. The Navy's Response to Comments included both AOC I and AOC R. Work at AOC I was presented in Draft Interim RI for AOC I, dated January 2005. Comments to the AOC I Draft Interim RI were provided in February 2005. Additional evaluation of Responses and/or issues pertaining to AOC I may be provided during the review of the future documents.

## II. PAGE-SPECIFIC COMMENTS

**PREQB Comment 5**, Page ES-2, Paragraph 4 – Borings for monitoring wells should be logged continuously, rather that every five feet, over which the screen interval is to be emplaced.

**Response: Past experience of drilling and logging of boreholes in west Vieques indicates that the water table is found at the top of or within the saprolite/bedrock unit. Subsequent monitoring wells locations will be sampled at 5-ft intervals until the saturated zone is encountered, then continuous sampling will begin. Continuous samples will be collected through the screened interval using either split-spooning or coring. Bedrock coring will be accomplished on three borings for monitoring well installation at each site, all other borings will be drilled using the air hammer method and cuttings will be logged. An alternate to coring is video logging the screened interval.**

*Evaluation of Response:*
Two borings (suggested MW-2 and MW-5) should be advanced using continuous split-spoon sampling in order to obtain a continuous subsurface profile across the site. Split spoon sampling at five-foot intervals during the advancement of the remaining borings will be sufficient to verify subsurface strata. Subsurface soil should be field screened.

**Navy Response:**
**Continuous soil sampling by split spoon will be done on three monitoring wells (MW-1, MW-3, and MW-6) until bedrock is encountered. Continuous rock coring will also be attempted at these three well locations if the wells are to be installed in bedrock (i.e., saturated zone not identified in the unconsolidated zone). Five-foot interval sampling in the unconsolidated zone and, if applicable (i.e., in bedrock), video logging of the**

**consolidated screen interval will be conducted on the remaining well locations. Section 4.3.2 Monitoring Well Installation, page 4-4, first sentence of the second paragraph after the bulleted list will be edited to read "Soils from monitoring well locations MW-1, MW-3, and MW-6 will be continuously logged to bedrock using split spoon samplers. If the saturated zone is not detected in the unconsolidated zone, continuous rock coring will be attempted to the total depth of the well in bedrock. The soil at all other boring/well locations will be sampled at 5-ft intervals by split spoon to bedrock, then air rotary to the total depth of the boring/well if the saturated zone is not detected in the unconsolidated zone. All soil collected will be lithologically described and screened with a PID for the presence of volatile constituents. If contamination is suspected based on visual observation or PID readings, a sample will be collected for analysis in accordance with the site analytical protocol." The Executive Summary will also be revised to reflect this information.**

**PREQB Comment 18**
Section 3.1.2 – Section 5.2.2 states that a default residential land use will be assumed for each site. Therefore, only residential screening criteria should be used. Eliminate Industrial screening criteria from the list. Also, the migration to groundwater screening criteria should be based on a dilution factor of 1, not 20. The use of a DAF factor of 20 must be supported by site-specific data that demonstrates that this DAF is appropriate (i.e., hydraulic conductivity, hydraulic gradient, size of impacted area and depth of aquifer mixing zone). The hydrology of the sites has not been evaluated.

**Response to PREQB Comment 18**
**All the surface soil data have been screened against residential PRGs for soil. All the subsurface soil samples have been screened against industrial PRGs. Chemicals identified as COPCs were evaluated for residential and industrial scenarios. Therefore, both residential and industrial PRG values were listed in Section 3.1.2. At the completion of the RI, the site conditions will be evaluated to determine whether a DAF of 20 is appropriate. Total organic carbon (TOC) and bulk density data will be obtained at both sites. These data may be used to calculate a site specific SSL, if required.**

*Evaluation of Response:*
The evaluation of the DAF based on site-specific data at the end of the RI is acceptable. However, please note that if a more conservative DAF should be used, then soils should be re-screened at the lower SSL. Further investigation may be required if COPCs are identified base don site-specific SSLs that were excluded from analysis in the RI.

**Navy Response:**
**The soil leachability to groundwater evaluations help determine potential for leaching of constituents to groundwater from soil. If groundwater is found not to be contaminated, then site soils may not be leaching contamination to groundwater, particularly at sites where operations ceased several decades ago, such as AOC R. While SSL values (even site-specific ones) are useful for screening, they are not likely to serve as a direct measurement of leachability. Both groundwater and soil data from the site are most applicable in determining contaminant conditions at a site. Thus, during the screening phase, both soil and groundwater screening will be utilized in determining soil leachability potential at AOC R, prior to refining the SSLs. Further, as noted in the original response, TOC and bulk density data will be collected during the RI.**

**PREQB Comment 24**
Figures 3-1 and 3-2 - The conceptual site models should show all receptors and exposure pathways considered and should include the rationale for eliminating receptors and exposure pathways from consideration for each site as required by US Environmental Protection Agency (EPA) Risk Assessment Guidance for Superfund (RAGS) Part D guidance (which is listed in Section 5.2 as a reference for conducting the human health risk assessment).

**Response to PREQB Comment 24**
**The following rationale has been added: "No surface water bodies are present on either site; therefore, the aquatic, surface water, and sediment pathways are not considered."**

***Evaluation of Response relating to Figure 3-2*:**
As requested in PREQB's original comment, please include all considered exposure pathways and a rationale for eliminating receptors and exposure pathways from further evaluation, as required by EPA RAGS Part D guidance.

**Navy Response:**
**Based on the May 5, 2005 site visit by the Technical Subcommittee, the ephemeral stream near the western boundary of AOC R has been added to the site for the purposes of investigation. Figure 3-1 has been revised (see Attachment 3) to reflect potential migration pathways and receptors associated with the ephemeral stream, as applicable.**

**PREQB Comment 25**
A construction worker should be added to the conceptual site models unless both sites will have institutional controls that eliminate future construction activities. The ingestion of home-grown vegetables exposure pathway should be included in the CSMs. Once the chemicals of potential concern have been identified in soils from 0 to 3 feet bgs, an evaluation of whether this pathway is a potentially complete pathway can be conducted. It should be noted that MADEP has guidance for quantifying this exposure pathway. Sampling depths should be consistent with root depths for produce grown in this region.

**Response to PREQB Comment 25**
**Construction worker is assumed to be represented by the utility worker scenario included in the work plan. If site operations-related chemicals are identified in site media, and these chemicals have bioaccumulation potential, then secondary exposure pathways such as ingestion of home-grown produce will be considered. As part of this phase of investigation at the end of the RI, if the team identifies this indirect pathway is a potential exposure pathway of interest, then it will be evaluated at that time. The exposure quantification will be consistent with other RI sites already evaluated for the Former NASD, and reviewed by PREQB. The surface soils are collected from 0 to 6 inches below surface consistently across all sites investigated thus far. This work plan will be consistent with the previous investigations.**

***Evaluation of Response*:**
Due to the nature of known historic activities that took place on the concrete pad (carpenter shop), please include VOCs in the suite of analysis for surface and subsurface soil and groundwater samples. Due to the volatility of VOCs, it is unlikely that they would be detected in shallow surface soil if present due to historic releases. The only quantitative

data available is from surface soil samples collected from 0 to 6 inches bgs. The only information available related to VOCs in subsurface soil is OVM readings taken from soil 6 to 12 inches bgs. Therefore, PREQB requests that surface soil samples be collected from 6 to 24 inches in areas where there is information indicating that shallow surface soil has been reworked (e.g., grading, vegetation removal) and from 0 to 24 inches elsewhere. Please include a discussion of whether historic information, including historic photographs discussed in the Environmental Baseline Survey report, show reworking of soils at this site in the past. This type of information is helpful in determining the appropriate depth for surface soil samples to ensure that the data quality objectives for human and ecological risk assessment are met.

Please note that it is irrelevant whether surface soil sample depths for this site are consistent with other investigations. Surface soil sample depths should be based on the nature and history of releases.

**Navy Response:**
**TCL VOCs will be included in the analytical protocol for samples collected during the RI. In accordance with EPA Comment 3 and based on the surface soil sample depth selection criteria document distributed by EPA during the March 29, 2005 Technical Subcommittee Meeting (see Final Meeting Minutes), surface soil samples will be collected from 0 to 24 inches at AOC R. Further, the rationale for sampling 6 to 24 inches is not technically sound. By definition, potential exposure to surface soil would take place within the top 24 inches, not from 6 to 24 inches. Data from 6 to 24 inches does not reflect the appropriate surface soil interval to which any potential current or future receptor would be exposed. Any reworking of the soil does not affect the potential exposure scenarios.**

**PREQB Comment 30**
Section 4.3.2, paragraph 1 - The hydrology of the site has not been determined. Therefore, it is unknown whether groundwater impacts are present 100 feet away from potential source areas. A monitoring well should be placed adjacent to and downgradient from concrete pad in the vicinity of the former carpentry shop. A monitoring well should be placed adjacent and downgradient from the former mechanics shop. Please correct location of MW03 and MW04. The text refers to MW05 located to the northwest and MW06 located to the northeast; however, figure 4-3 is not consistent with this description.

**Response to PREQB Comment 30**
**The location of the former carpentry shop is unknown. There is no known former mechanics shop at the site. Figure 4-1 has been revised to re-locate the monitoring well locations.**

***Evaluation of Response:***
The response does not address the rationale for placing monitoring wells 100 feet downgradient from the concrete pad.

Please provide further discussion on the rationale for installing MW-3 and MW-4 100 feet downgradient from the concrete pad. It is unclear that these locations will provide information on groundwater quality within the likely source area.
Please specify the distance from the former AST to the proposed upgradient monitoring well location. Please clarify if the proposed location for MW-1 is also upgradient from the possible location of the AST indicated by the current location of the tank supports.

Please provide further discussion on the purpose for MW-7.

**Navy Response:**
**The well locations will be adjusted in accordance with EPA Comment 18.**

**PREQB Comment 32**
Section 4.3.2.2, paragraph 1 - Appropriate TPH analysis should be included in the analytical suite to provide data to evaluate potential risks associated with petroleum contamination.

**Response to PREQB Comment 32**
**There are no known petroleum storage tanks at the proposed sampling locations. Therefore, TPH analysis will not be performed at this time.**

***Evaluation of Response*:**
TPH analysis should be conducted to determine if historic activities have resulted in petroleum impacts to groundwater. Please include appropriate TPH fraction analysis (to be determined by EPA) in the analytical suite.

**Navy Response:**
**Sampling associated with potential petroleum contamination at AOC R will be conducted in accordance with the discussion documented in the draft Meeting Minutes for the June 21, 2005 Technical Subcommittee Meeting. Because AOC R is not a UST site, the samples will be analyzed for VOCs and SVOCs to account for potential contamination by petroleum constituents. No TPH analysis will be conducted at AOC R.**

**PREQB Comment 33**
Section 4.3.2.4, paragraph 1 - The analytical suite for the AST should include metals, PCBs and pesticides unless historical records are available that indicate what the contents of the AST were. The analytical suite for surface and subsurface soil samples in the vicinity of the concrete pad should include VOCs due to historical use of the pad as a carpentry shop. Appropriate TPH and VOC analysis should be included for surface and subsurface soil samples collected in the former mechanics shop (vehicle maintenance) area.

The purpose of the sampling is to characterize impacts associated with historic releases at this site. Past uses include a mechanics shop and carpentry shop. These types of shops typically use and dispose of various volatile organic compounds (VOCs). Historic uses should be considered in determining appropriate analytical methods. Therefore, VOCs should be included in the list of analyses for soil.

**Response to PREQB Comment 33**
**Metals, pesticides, and PCBs have been added to the parameter list for the soil samples around the AST. In Section 4.3.2.4, paragraph 1, sentence 1, will read: "Four surface soil and four subsurface soil samples will be collected around the former AST south of Highway 200 and analyzed for metals, TPH, VOCs, SVOCs, Pesticides and PCBs." Samples from a total of 24 sample locations around the concrete pad were analyzed for VOCs during the Expanded PA/SI. Results indicated that VOCs were either not detected or were detected at concentrations below applicable screening criteria. Therefore, soil samples from around the concrete pad will not be analyzed further for VOCs. No mechanics shop is known to have existed at the site. A total of 10 sample locations in the vehicle maintenance area were analyzed for VOCs during the Expanded PA/SI. Results**

**indicated VOCs were either not detected or were detected at concentrations below applicable screening criteria. However, to further characterize the area, seven surface soil samples and four subsurface soil samples will be analyzed for VOCs and SVOCs in the vehicle maintenance area.**

*Evaluation of Response*:
Please add VOCs and appropriate TPH fraction analysis (to be determined by EPA) to the analytical suite for surface and subsurface soil samples since previous samples were collected from 0 to 6 inches, a depth at which VOCs from historic releases are unlikely to be detected. Therefore, PREQB is requesting the additional surface soil samples representing soils from 6 to 24 inches below grade be collected adjacent to the concrete pad.

Also, please use field screening using headspace analysis to determine the depth at which subsurface soil samples will be collected. If field screening does not indicate the presence of subsurface impacts, the default depth should then be 4 to 6 feet bgs.

**Navy Response:**
**Please see response to PREQB evaluation of response to comments 25 and 32. In addition, in accordance with the final Meeting Minutes from the March 29, 2005 Technical Subcommittee Meeting, subsurface soil sampling depths will be determined based on field screening results. A default depth of 4 to 6 feet below grade will be selected if field screening or site-specific data do not indicate that a different depth is more appropriate.**

**PREQB Comment 34**
Table 4-8 - The TPH method listed is 314. Please provide documentation for this method prior to conducting field sampling. As stated previously, the TPH analyses should be appropriate for the risk assessment methodology to be used to evaluate potential risks associated with petroleum contamination.

**Response to PREQB Comment 34**
**The TPH analysis will be conducted by SW846 Method 8015M – GRO/DRO to be consistent with previous data collected during the RI. Risks will be evaluated using VOC and SVOC data. Table 4-8 has been revised.**

*Evaluation of Response:*
EPA has provided toxicity criteria for TPH fractions. Therefore, analysis and risk evaluations for human health should be consistent with this new approach.

**Navy Response:**
**Please see response to PREQB evaluation of response to comment 32.**

**PREQB Comment 46**
Page 4-9, Section 4.3.2.4, Table 4-8 –

a.) The laboratory must use the most current CLP SOW for SVOCs and metals, as is being done for the VOC method for groundwater and the metals method for AOC I in Table 4-4. Therefore, OLC02.1 must be changed to OLC03.2 for SVOCs and ILM04.0 must be changed to ILM05.2 for metals. It should be noted that the SVOC list in OLC03.2 contains additional compounds in comparison to OLC02.1.

b.) The current method listed for TPH is 314, which is a perchlorate method. This should be revised to be SW-846 8015B, assuming this is intended to measure TPH-DRO and TPHGRO. This was not clearly addressed in the text as it was for AOC I.

c.) The number of field duplicates for metals must be increased from two to three to meet the frequency requirement of 1/10 samples.

d.) The number of field duplicates for SVOCs must be increased from two to four to meet the frequency requirement of 1/10 samples.

**Response to PREQB Comment 46**

**a.) Table 4-8 has been revised to include the most current methods that will be used for this project.**

**b.) SW846 Method 8015M – GRO/DRO will be used to characterize TPHs.**

**c.) The number of field duplicates for metals has been changed from two to four.**

**d.) The number of field duplicates for SVOCs has been increased from two to four.**

*Evaluation of Response:*

a.) The methods in revised Table 4.4 must be updated to the current methods:

SVOCS – OLM04.3

Pest/PCBs/VOCs – OLC03.2

**Navy Response:**
**The methods in both Tables 4-3 and 4-4 have been updated and are shown below.**

**Table 4-3: Groundwater and Surface Water**

| Parameter | Method |
|---|---|
| VOCs | LL-OLCO3.2 |
| SVOCs | LL-OLCO3.2 |
| Total Metals | ILM06.X |
| Dissolved Metals | ILM06.X |
| TDS | 160.1 |
| Pesticides/PCBs | LL-OLCO3.2 |
| Explosives | SW846 8330 |
| Thallium | SW846 7841 |

**Table 4-4: Soil and Sediment**

| Parameter | Method |
|---|---|
| Metals | ILM06.X |
| SVOCs | OLM04.3 |
| Explosives | SW846 8330 |
| Pesticides | OLM04.3 |
| PCBs | OLM04.3 |
| VOCs | OLM04.3 |
| Thallium | SW846 7841 |

b.) EPA will provide the appropriate analytical method for evaluation TPH fractions.

**Navy Response:**
**Please see response to PREQB evaluation of response to comment 32.**

c.) The revised text indicates that the number of field duplicates for metals has been changed from two to five.

**Navy Response:**
**Table 4-4 Soil Sample Parameters, Methods, and Quantities for AOC R, lists the number of field duplicates as 5 for Metals. The most important piece of information in the table is the duplicate collection rule, which states that duplicates will be collected one per 10 samples, as stated in the Notes of Table 4-4. Tables 4-3 and 4-4 will be revised to remove the actual number of various QA/QC samples, and replace them with the collection frequency.**

d.) The revised text indicates that the number of field duplicates for SVOCs and VOCs has been increased from two to five.

**Navy Response:**
**Table 4-4 Soil Sample Parameters, Methods, and Quantities for AOC R, lists the number of field duplicates as 5 for both SVOCs and VOCs. The most important piece of information in the table is the duplicate collection rule, which states duplicates will be collected one per 10 samples, as stated in the Notes of Table 4-4. Tables 4-3 and 4-4 will be revised to remove the actual number of various QA/QC samples, and replace them with the collection frequency.**

## III. PREQB Comments not included in the NAVY Response to Comments provided in Appendix F

Pages 4-7 and 4-8, Section 4.3.2.2 – Provide the rationale for installing thirty and fifty foot wells to investigate pesticides and PCBs, and other relatively immobile constituents, in the context of the basic fate and transport characteristics of these compounds, the type of release event(s) known or presumed to have occurred at AOC-R (e.g., sudden high volume releases over a short period of time, small incidental releases over a long period of time, subsurface injection, etc., as applicable), and the properties of the overburden (e.g., fine grained and highly organic or highly permeable). A fraction of the cost and level of effort associated with the installation of the wells could be used to evaluate the potential for deep subsurface migration of low-mobility contaminants.

**Navy Response:**
**The monitoring wells are to be installed at first-encountered groundwater, the most common interval to sample during this type of RI (i.e., initial). Subsurface screening and sampling are also being conducted during the RI.**

Section 5 - The method for evaluating petroleum contamination in the HHRA should be included in the HHRA work plan. The PA/SI Phase II report indicates that petroleum contamination above 100 mg/kg "…is an indicator of a petroleum release, but does not serve as a risk-based criterion to assess risk to human health…" This statement indicates

that petroleum data will be evaluated in the human health risk assessment. If that is the case, the method for evaluating petroleum data should be provided in the HHRA and appropriate analytical methods should be employed to ensure that the data reported is consistent with the toxicity values and chemical and physical parameter values used in the risk assessment to evaluate exposure to petroleum hydrocarbon contamination. (Note that this comment has been reproduced herein for completeness' sake as it was excluded from the Navy's response to comments. However, the new approach for evaluation TPH based on EPA's PPRTVs for TPH fractions supersedes this comment.)

In accordance with EPA RAGS Part D, each section should identify the tables that will be provided as interim deliverables for regulatory review and a schedule should be provided that identifies the timeframe for submittal of these interim deliverables.

**Navy Response:**
**Regarding TPH analysis/evaluation, please see response to PREQB evaluation of response to comment 32.**

**Regarding the second paragraph above, Tables 1 through 6 will be submitted as an interim deliverable, including text that supports and explains the tables.**

Section 5.2, paragraph 1 - This section should include EPA's RAGS Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim EPA/540/R/99/005 (September 2001) and EPA's Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (November 2002).

EPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (1997)* document supersedes the *Environmental Evaluation Manual (1989)*. Please use this reference in conducting the ecological risk assessment and replace the outdated reference in this section.

**Navy Response:**
**In the human health risk assessment methodology section, the two references suggested in the comment above will be added to the list of references provided in Section 5.2. In the Ecological risk assessment, the 1997 EPA reference will be used when conducting the ERA, in addition to applicable Navy ERA guidance. All references to the 1989 EPA document will be removed.**

Section 5.2, paragraph 2 - The CSMs should present all receptors and exposure pathways considered and the rationale for exclusion, as required by EPA RAGS Part D.

**Navy Response:**
**The CSM has been revised (see Attachment 3) to include all potentially applicable pathways based on current knowledge of environmental exposure media, exposure pathways and exposure routes. The CSM will be revised, as appropriate, following collection of the RI data. The exposure pathways evaluated in the risk assessment will be consistent with those presented in the CSM and the Table 1 of the RAGS Part D tables.**

Section 5.2.2, paragraph 2 - It should be noted that the use of land uses other than residential will require institutional controls restricting activities and uses of the sites.

**Navy Response:**
**Following completion of the risk assessments, recommendations will be made regarding the need for a feasibility study to address unacceptable levels of potential risk, if present. If a feasibility study is necessary, it will identify the need for institutional controls for remedies that do not result in unrestricted land use.**

Section 5.2, paragraph 7 - It is not acceptable to restrict the evaluation of a residential exposure scenario to one ½-acre area. The extent of each source area identified at each AOC should be used as the exposure area for all exposure scenarios. The only reference to ½-acre exposure areas is provided in EPA's Soil Screening Guidance User's Manual and EPA points out that this size was used to represent a standard suburban residential lot. Unless it is known that these sites will be developed into ½-acre lots, the exposure area should represent each release area at each AOC. The maximum or 95% UCL concentration for each COPC should be used for all exposure scenarios. Furthermore, EPCs should be calculated using data representative of the exposure scenario and pathway. An industrial worker will likely be exposed to contaminants in surface soil. A construction worker will be exposed to surface and subsurface soil. EPCs should be calculated using datasets comprised of samples collected at appropriate sample depths.

**Navy Response:**
**All the samples collected within AOC R area will be used in estimating the exposure point concentrations (EPCs), as one exposure unit, as suggested by the comment. An industrial worker exposure will be evaluated for surface soil, along with other appropriate exposure scenarios for this medium. The subsurface soil will be evaluated the industrial use exposure scenario.**

Section 5.2.3, paragraph 1 - EPA considers HEAST a Tier III reference. The appropriate hierarchy is (1) IRIS, (2) provisional values obtained from EPA, and then (3) then other values, including HEAST values. Refer to EPA's Memorandum entitled "Human Health Toxicity Values in Superfund Risk Assessments" dated December 5, 2003. Toxicity criteria should be provided as an interim deliverable for regulatory review as required by RAGS Part D.

The EPA-recommended adherence factor for a child playing outdoors is 0.4. Please revise the table accordingly.

For dermal exposure to soil, EPA considers impact to be associated with a monolayer adhered to the skin. Therefore, exposure time should reflect at least 8 hours, since it is unlikely that a child or youth would immediately take a bath to remove a residual monolayer after leaving the site. Dermal contact continues until the skin is washed.

Please clarify why the exposure frequency for a youth is 45 days and the exposure frequency for a child is 50 days.

For those values that are footnoted with note "b," please provide supporting documentation that shows how the value was adapted from data presented in the Exposure Factors Handbook.

Please clarify what size site was used in calculating the PEF for this site.

As previously commented, the EPA-recommended showering time for an RME exposure scenario is 0.58 hour for an adult and 1 hour for a child.

**Navy Response:**
**The hierarchy of the toxicity value selection from the databases will be followed as suggested by the comment, and previously implemented at other RI sites within west Vieques.**

**A dermal adherence factor of 0.2 was previously used. Table 5-1 will be revised to include the soil-skin adherence factor of 0.4 recommended by this comment, and this value will be used in future risk assessments.**

**As stated previously, exposure times are not used in the equations to evaluate dermal exposure to soil. Therefore, all references to exposure time in Table 5-1 will be removed.**

**Recreational visitors are typically assumed to visit sites and ditches 1 day every week, with an exposure frequency of 52 days/year. The values listed in Table 5-1 will be changed to reflect this, which is consistent with previously completed risk assessments at other RI sites.**

**The word 'adapted' will be deleted because none of the values were modified from the guidance.**

**The PEF value used is the default value from EPA SSL guidance. It is based on 0.5-acre square area. The industrial scenario will use the value listed in Table 5-1; however, the residential PEF value will be changed to $4.4 \times 10^8$, per the SSL guidance (*Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*, Peer Review Draft, OSWER 9355.4-24. March, 2001).**

**Showering times will be consistent with EPA Region 2 RME default values.**

## IV. NEW COMMENTS BASED ON NEW TEXT OR DISCUSSIONS IN TECHNICAL MEETINGS

Section 5.2.1 - Maximum Contaminant Levels are not risk-based, in some cases, and are not appropriate for use as screening criteria. EPA Region 9 tap water PRGs should be used to screening groundwater. In the second sentence of the second paragraph, please replace the word "monitoring" with "characterization." Also, please include a discussion of indirect exposure pathways that will be evaluated in the human health risk assessment. A discussion of whether the ingestion of home-grown vegetables is of concern should be addressed.

**Navy Response:**
**MCLs have not been used in selecting COPCs for risk assessment. The text will be edited to clarify that groundwater COPCs will be selected based on comparison with EPA Region tap water PRGs. However, MCLs will be listed in the ARARs column, in keeping with the RAGS Part D table format.**

Section 5.2.2, paragraph 7 - Please clarify why only soil within the upper most 6 feet will be evaluated for direct exposure during excavation.

**Navy Response:**
**Typical construction extends up to 6 ft below surface, and evaluation of subsurface soil to this depth is consistent with EPA policy. This will be clarified in the revised text.**

Section 5.2.2, paragraph 8 - The presence or absence of VOCs at this site still needs to be determined. Previous sampling is not sufficient to conclude that VOCs are not of concern for soil below 6 inches bgs. Therefore, the evaluation of VOCs should be quantitative unless the results of this more thorough investigation demonstrate that VOCs are not present at the site.

**Navy Response:**
**VOCs will be added to the analytical protocol for AOC R samples.**

Section 5.3.1.2 - As requested in other work plans, please use EPA's Eco-SSLs as screening criteria unless adequate justification is provided for using Region 4 values. Screening criteria for surface water and sediment should also be provided in this section, since it has yet to be determined whether historical activities have impacted the stream located adjacent to the boundary of the site. This section should be consistent with other sections, such as Section 5.3.2.1, which refer to concentrations of chemicals detected in surface water and sediment and upper trophic level receptors.

Please include a list of proposed references for ecotoxicity criteria (or the development of ecotoxicity criteria) for upper trophic level receptors.

**Navy Response:**
**Please see response to EPA comments 11 and 38.**

Section 5.3.3.1 - Please use literature sources approved by EPA Region 2.

**Navy Response:**
**Please see response to EPA comments 11 and 38.**

Section 5.4 - In accordance with the National Contingency Plan, a 1E-06 cancer risk level is the starting point for cleanup actions, modified by site-specific or remedy-specific factors such as exposure factors, uncertainty factors and technical factors applied as the agencies deem appropriate. Therefore, at this stage in the cleanup process, the remedial goal options should be estimated based on an excess cancer risk of 1E-06. This value may be modified by the agencies based on an assessment of land uses, technical remediation considerations and other factors that may result in a less stringent overall cancer risk. Please revise this section to reflect the more appropriate cancer risk level and the discussion of such modifying factors that may result in a less stringent cleanup level.

**Navy Response:**
**The work plan will be revised to be a Remedial Investigation work plan only (Feasibility study components will be removed). To that end, Section 5.4 and Section 6 will be**

**removed, and text within the remainder of the document will be revised appropriately to reflect an RI work plan. If a Feasibility Study is deemed necessary, based on the findings of the RI, it will be recommended in the RI Report.**

Section 5.4.2 - The text should clarify the term "low risks."

**Navy Response:**
**Please see the response to PREQB comment on Section 5.4 above.**

Table 5-1 - The EPA-recommended ingestion rate for a construction worker is 330 mg/day. Since the Navy has indicated that the construction worker and utility worker represent the same exposure scenario, please revise the ingestion rate to reflect current EPA guidance on evaluating construction worker exposure. The EPA-recommended skin surface area is 5,700 $cm^2$. Please revise the table accordingly.

**Navy Response:**
**The RI reports completed for other sites within west Vieques used an ingestion rate of 330 mg/kg for a construction worker, and the same will be used for this site. Table 5-1 will be revised to include this value. The skin surface area assumed for exposure includes head, hands, forearms, and lower legs, which adds up to 3300 $cm^2$ as listed in Exhibit 3-5 of RAGS Part E guidance referenced above (EPA, 2001). This value was used for other RI risk assessments and, therefore, will be used for AOC R. The skin surface area for the adult resident will be changed to 5,700 $cm^2$.**

**Fish and Wildlife Services**

Thank you for your request for comments regarding the Area of Concern R (AOC-R) on Vieques Island. This site was identified as a vehicle maintenance area, construction staging area, public works area from 1965 to 1971. Although the concrete pad was existed prior to the Navy's presence on Vieques, there seems to be no records of the area's use prior to the 1960's.

During the previous investigation work on the site, military items were found and worked was stopped. This plan addresses newly found items and additional sampling sites. The Service previously commented on this site in July 2004. At that time we mentioned the existence of an ephemeral or intermittent stream immediately west of the site which also passes by and is part of AOC-J further north.

The Service and EPA surveyed the stream adjacent to AOC-R in August 2004. The stream flows north from Monte Pirata and Cerro Buey, crosses under road PR-200 immediately southwest of AOC-R and flows along the western boundary of AOC-R until it takes a more northwesterly course towards AOC-J. The stream is deeply incised at this point and the bed of the stream may be in contact with bedrock. Stream sediments consisted of coarse sand and cobbles. The inspection started north of the concrete pad. The banks of the stream here were altered and it seemed that material was bulldozed into the stream. The stream bed is littered with metal scrap, and the east bank of the stream contained numerous metallic items. Also buried into the bank were several 2.75 inch rocket pods. At the time of the inspection the area where this material was dumped was dry. However less than 20 meters

down stream starts a series of interconnected pools of water, which eventually become a water filled stream channel as the site nears AOC J (see enclosed photos).

Based on the information provided and the discussions concerning the site in recent telephone conference calls we have the following comments:

1) The site boundary should be extended to include the stream.

   **Navy Response:**
   **As concurred upon by the Technical Subcommittee, the ephemeral stream has been added to the AOC R conceptual site model (see Attachment 3) and RI sampling activities. Sample locations in the ephemeral stream were selected by the Technical Subcommittee during a site visit on May 5, 2005 (see Final Meeting Minutes for the May 4-6, 2005 Site Visit and Attachment 4).**

2) In order to better characterize the nature and extent of contamination the trash along the eastern bank of the stream should be excavated to see if additional MEC or ORS items remain buried.

   **Navy Response**
   **As described in the Final RI/FS Work Plan for AOC R (CH2M HILL, January 2005), an avoidance survey will be conducted within the debris areas at AOC R, in the vicinity of where the munitions items were identified. The appropriate geophysical technique will be employed to identify the potential presence of other munitions items. If geophysical anomalies are identified, additional munitions identification and clearance activities will be conducted. In addition, the Navy will remove the existing MEC and associated debris. The Work Plan will be revised to clarify this process.**

3) Since there is continuity with AOC J, water and sediment samples previously taken from AOC J may represent down gradient contamination from AOC R or a combination of both.

   **Navy Response:**
   **As noted in the response to FWS Comment 1, potential surface water and sediment sample locations in the ephemeral stream at AOC R were identified during the Technical Subcommittee site visit on May 5, 2005. The surface water and sediment conditions at AOC J, with respect to depositional environment and constituents detected, will be evaluated for potential use in interpretation and assessment of AOC R surface water and sediment data collected during the RI.**

4) Samples should be taken down stream of the existing trash piles in the areas where permanent standing water is found.

   **Navy Response:**
   **As noted in the response to FWS Comment 1, potential surface water and sediment sample locations in the ephemeral stream at AOC R were identified during the Technical Subcommittee site visit on May 5, 2005 (see Attachment 4). These locations were selected at the debris area in the stream, and up and downstream of this area at the locations of standing water. It should be noted, however, that standing water may not be present at the time of sampling. In addition, as stated in the response to FWS Comment 3, the surface water and**

**sediment data at AOC J will be evaluated for potential use as downgradient surface water/sediment data for AOC R.**

5) In order for reviewers to understand the relationship between the two AOC sites, AOC J should be shown in Figure 2-2 of the document.

**Navy Response:**
**Figure 2-2 will be revised to show the location of AOC J. In addition, surface water and sediment samples collected at AOC J will be shown in Figure 4-1, making note that they are existing (not proposed).**

6) In our previous letter we mentioned an additional structure which may or may not be related to the site. This is the building in Figure 1-3 that is seen north of the access restriction boundary. This question has been asked by both the agencies and the TRC.

**Navy Response:**
**The historical use of the structure is unknown.**

7) Conceptual site models and hydrology models need to be modified to include the adjacent stream.

**Navy Response:**
**The conceptual site model has been revised to include the stream, and is attached to these response to comments as Attachment 3.**

APPENDIX G

# Munitions Response Procedures for AOC R

# Ordinance Related Scrap (ORS) Metal Collection and Inspection Procedures

# Contents



## List of Figures

# 1.0 Purpose

This SOP is intended to guide MEC Technicians in the safe and efficient handling and disposal of ordnance related scrap metal found at CH2M HILL project sites. The inherently dangerous characteristics of AEDA dictate that special precaution be taken to ensure that demilitarization is performed only by properly trained and technically qualified personnel.

# 2.0 Background

During investigation operations, MEC Technicians will encounter the following types of metallic contamination: MEC items; ordnance related scrap that is contaminated with explosives or other hazardous materials; non-hazardous ordnance related scrap metal; and general metallic debris. Because the metal scrap recovered will ultimately be disposed of offsite, it is imperative that procedures be established to preclude live ordnance or hazardous materials from becoming intermingled with other non-hazardous metal scrap.

Current and past practices have only required the inspection of ordnance related scrap and a certification by a qualified EOD/MEC technician that it is safe to the best of their knowledge. There are several pitfalls with this approach depending on the type of ordnance being inspected. The following paragraphs provide guidance for avoiding these pitfalls.

**References:**

DoD 4160.21-M: Department of Defense Reutilization and Marketing Manual

DoD 4160.21-M-1: Department of Defense Demilitarization Manual

TB 700-4: Department of the Army Technical Bulletin - Decontamination of Facilities and Equipment

# 3.0 Collection Procedures

A systematic approach for collecting and inspecting metal scrap will be used. The approach is designed to ensure that the materials undergo a continual evaluation/inspection process from the time acquired until finally removed from the site.

At the operating site, we will preposition scrap metal containers. Which will be marked "Non-ordnance Scrap Metal" and will be used to collect general metal debris. The other container(s) will be marked "Ordnance Related Scrap Metal" and will be used to collect non-hazardous ordnance related scrap metal (i.e. Metal components that do not contain any explosives or other hazardous materials).

Collection procedures begin at the time the metal item is discovered by the MEC Technician. At this point the MEC Technician makes a preliminary determination as to the classification of the item. If the item is identified as non-ordnance related scrap it is placed in a temporary Non-ordnance scrap pile located within the current operating area. If the item is identified as ordnance related scrap it is placed in a temporary ordnance related scrap pile, again this pile is located within the current operating area.

Upon completion of operations within an area, the MEC Supervisor for the team that cleared the area will inspect each of the scrap piles and direct movement of the scrap into the appropriate site collection container. To preclude migration of the material from one pile to the other during movement to the scrap containers, each pile will be moved as a distinct and separate vehicle load.

# 4.0 Removal of Scrap Metal/Range Residue

The MEC Team will collect the scrap piles deposited at the operational area by the MEC Clearance Team, perform an inspection to confirm that segregation of the ordnance related scrap had been done correctly and that no live MEC has been placed in the ordnance related scrap pile. The ordnance related scrap will be inspected and divided into two groups: 1) ordnance related scrap requiring further demilitarization; and 2) ordnance related scrap that does not require further demilitarization. **Figure 1** is a Logic Diagram for the Collection and Disposition of ORS.

## 4.1 Segregation of Scrap Metal/Range Residue

For purposes of disposal, it shall be segregated and defined as either Group 1a, Group1b, or Group 2.

### 4.1.1 Group 1 Scrap Metal/Range Residue

Group 1 includes property that previously contained explosives or that does not contain items of a dangerous nature and can be certified inert and/or free of explosives or other dangerous materials such as targets, certain expended ordnance, etc.

#### 4.1.1.1 Group 1a Scrap Metal/Range Residue

Group 1a includes firing range expended small arms cartridge and inert metals gleaned from range clean up. Metals gleaned include material for which the only use is for its basic material content (e.g. clean shrapnel, target metal, etc.) And does not include material with any residual utility or capability or that is considered to be MLI or CCLI. Such material is eligible under the Resource Recovery and Recycling Program for disposition by a QRP in accordance with DODI 7514.1, Pollution Prevention. DOD Components may exercise direct sale authority for firing range expended small arms cartridge cases provided that it is crushed, shredded or otherwise destroyed prior to release from DOD control.

#### 4.1.1.2 Group 1b Scrap Metal/Range Residue

Group 1b includes any certifiable material or item not meeting the criteria in 1a above. A determination shall be made as to whether the material/item requires demilitarization. Damaged sustained does not necessarily constitute demilitarization. Destruction shall, at a minimum, satisfy the provisions of DOD 4160.21-M-1. This material is not eligible for a QRP.

### 4.1.2 Group 2 Scrap Metal/Range Residue

Group 2 includes inherently dangerous items that may potentially contain munitions residue and cannot be certified as inert, such as practice bombs (that is, Aduds,≅ unexploded ordnance (MEC), BDU-33, MK-106, etc.)

# 5.0 Disposition of Munitions List Items (MLI)

Demilitarization should be accomplished by the most cost effective method consistent with adequate security and surveillance as economically as practical in accordance with existing environmental standards, safety and operational regulations, to the point of assuring freedom from explosives, toxic or incendiary materials, smoke content or design hazards by one of the following methods:

a) By a sales contractor, as a condition of sale. Unless otherwise authorized, property to be demilitarized by this manual must be demilitarized prior to transfer of title to a purchaser.

b) By the DRMO, generating activity, designated Military Service/Defense Agency or contractor personnel (having qualified MEC personnel).

c) Under a service/performance contract.

## 5.1 Assignment of Demilitarization Codes

The proper procedure requires that ordnance scrap be assigned a demilitarization code and that code determines the type of processing required. For almost all ordnance scrap the assigned code should be AG≅. Assignment of this code is the responsibility of the generating activity (for range maintenance contracts such as Fort Irwin it is the National Training Command; for base realignment and closure (BRAC) removal actions it is the BRAC office; and for formerly used defense sites (FUDS) it is the Corp of Engineers). CH2M HILL as the contractor and expert in MEC should assist the generating activity in determining the demilitarization code to be assigned and the method and degree of demilitarization required.

Definition of Demilitarization Code AG≅:

AG≅ MLI -- Demilitarization required - AEDA, Demilitarization, and if required, declassification and/or removal of sensitive markings or information, will be accomplished prior to physical transfer to a recycling facility. This code will be used for all ADEA items, including those which also require declassification and/or removal of sensitive marking or information. [When in doubt assign Demilitarization Code AG≅ for all recovered ordnance related scrap.]

## 5.2 Demilitarization Requirements

Demilitarization and decontamination of ordnance scrap is based on a system that assigns decontamination levels commensurate with the post treatment use. For metal that is being released to the public as recyclable, 5X is the acceptable degree of decontamination.

Past practices for recovery and certification of ordnance scrap from range maintenance contracts, BRAC and FUDS removal actions have improperly certified ordnance scrap as safe for turn-in to DRMO for recycling based on inspection and certification by MEC/EOD technicians. In most cases this achieves a 3X level of decontamination by de facto. This is not sufficient for resale to the public. Three X=s indicate the equipment or facilities (in this case ordnance scrap) have been examined and decontaminated by approved procedures and no

contamination can be detected by appropriate instrumentation, test solutions, or by visual inspections on easily accessible surfaces or in concealed housings, etc. and are considered safe for the intended use. Items decontaminated to this degree can not be furnished to qualified DOD or Industry users or subjected directly to open flame cutting, welding, high temperature heating devices), or operations which generate extreme heat, such as drilling and machining. Newly implemented certification procedures require two signatures for certification of which only one signature may be from a government contractor.

The only acceptable way to get to 5X decontamination is by partial or complete removal, neutralization, or destruction of explosives/explosive residue by flashing, steaming, neutralization, or other approved desensitizing methods such as shredding. This is often expensive and nullifies the value of the scrap. However to leave ordnance scrap on a range site increases the possibility of residues such as RDX, HBX, and TNT entering the ground water and causing a more expensive problem.

Technical instructions issued by the Defense Agency or Military Service having procurement responsibility for the item involved and/or instructions provided through the DOD demilitarization Bulletin Board System, will determine and identify the method of demilitarization and the degree to which additional demilitarization is necessary to meet the requirements in their respective areas. For additional information contact the following:

a) For ammunition procured by the Department of the Army, technical instructions relating to ballistic missiles, and large rockets, will be furnished by the Commander, U.S. Army Aviation and Missile Command (AMCOM), Attn: AMSAM-DSA-WO, Redstone Arsenal, AL 35898-5239

b) For conventional, chemical, and all other types of ammunition excluding lethal chemical agents and waste munitions, technical instructions will be provided by the U.S. Army Industrial Operations Command, Attn: AMSIO-SMK, Rock Island, IL 61299-6000

c) For lethal chemical agents including vesicants and nerve agents and their carriers, technical instructions will be furnished by the U.S. Army Armament Material Readiness Command Program Manager for the demilitarization of Chemical Material, Edgewood Arsenal, Aberdeen proving Ground, Maryland 21010

d) For ammunition procured by the Department of the Navy, technical instructions will be issued by the Commander, Naval Sea Systems Commander or by the Commander Naval Air Systems Command, department of the Navy, Washington, D.C.

e) For ammunition procured by the Department of the Air Force, technical instructions will be issued by the Engineering and Reliability Branch (MMWR), Ogden Air Logistics Center, Ogden, UT 84056-5609.

The following paragraphs provide guidance for the method and degree of required demilitarization for most types of ordnance items:

### 5.2.1 Category III. Ammunition - Method and Degree of Required Demilitarization

a) **Artillery/Mortar Ammunition Components and Similar Items of All Types** including but not limited to high explosive, practice, inert loaded, incendiary, and smoke fillers.

Remove explosive filler from projectile (wash out, burn out, etc.). Remove rotating band and deform fuse cavity threads or score or deform bourrelet or gas check band. Burn propellant unless otherwise instructed to retain for sale or other purposes. Deform fin assembly threads or fin blades. Cartridge cases will be deformed by off-center punch-out of primer or split case neck or puncture the lower sidewall with a minimum of 3/4 inch hole or deform lower sidewall, which will prevent chambering, or crush or press. Burn out smoke mixture or detonate smoke canister.

b) **Inert Loaded Ammunition, Projectiles, and Similar Items of All Types** loaded with inert filler to simulate service item. Remove rotating band from artillery projectiles and open the closure of the projectile body to expose the inert filler. On items without rotating bands, open the body closure to expose the inert filler and damage the closure surface to prevent reloading or resealing.

**NOTE:** For inert loaded items (concrete, sand, plaster) a potential explosive safety hazard exists when the internal filler is not exposed or unconfined during burning. Melting, or cutting. Heat generated from a demilitarization process can cause the filler, moisture and air to expand and burst sealed casings. For this reason, DRMOs will not accept inert loaded items unless the internal filler is exposed and unconfined. The internal filler may be exposed by removal of the fuse well from the cavity, removal of base plates, or by puncturing/drilling holes I the bomb casing.

c) **Ammunition and Components Which Have Been Fired or Expended, Range Residue and Other Non-Explosive Items.** All items will be rendered free of energetic materials prior to accomplishment of demilitarization. Range residue will be processed in accordance with the defense Material Disposition Manual, DOD 4160.21-M, Chapter 4, paragraph B.3, after all required demilitarization is accomplished.

1. **Artillery/Mortar Ammunition Components and Similar Items of All Types.** Remove rotating band and deform fuse cavity threads or score or deform bourrelet or gas check band. Score practice round with a torch, displacing a minimum of one cubic inch of metal or shear into two pieces. Deform fin assembly threads and fin blades.

2. **Inert Loaded Ammunition, Projectiles, and Similar Items of All Types** loaded with inert filler to simulate service item. Remove rotating band from artillery projectiles and open the enclosure of the projectile body to expose the inert filler. On items without rotating bands, open the body closure to expose the inert filler and damage the closure surface to prevent relocating or resealing. **NOTE:** For inert loaded items (concrete, sand, plaster) a potential explosive safety hazard exists when the internal filler is not exposed or unconfined during burning, melting, or cutting. Heat generated from a demilitarization process can cause the filler, moisture and air to expand and burst sealed casings. For this reason, DRMOs will not accept inert loaded items unless the internal filler is exposed and unconfined. The internal filler may be exposed by removal of the fuse well from the cavity, removal of base plates, or by puncturing/drilling holes I the bomb casing.

*3.* **Other Nonexplosive Filled Items** which perform a major function essential to the basic mission of the end item. Cut, crush, or process through a deactivation furnace. Burn or

cut cartridge case lines and propelling charge bags. Cut, burn, or crush aircraft and ground signal cases. Crush or detonate piezoelectric (lucky) elements.

d) **Technical data** will be demilitarized by burning, shredding, or pulping.

### 5.2.2 Category V. Military Explosives, Solid and Liquid Propellants, Bombs, Mines, Incendiary Agents, and their Constituents - Method and Degree of Required Demilitarization

a) **Artillery/Mortar Ammunition Components and Similar Items of All Types** including but not limited to high explosive, practice, inert loaded, incendiary, and smoke fillers. Remove explosive filler from projectile (wash out, burn out, etc.). Remove rotating band and deform fuse cavity threads or score or deform bourrelet or gas check band. Burn propellant unless otherwise instructed to retain for sale or other purposes. Deform fin assembly threads or fin blades. Cartridge cases will be deformed by off-center punch-out of primer or split case neck or puncture the lower sidewall with a minimum of 3/4 inch hole or deform lower sidewall, which will prevent chambering, or crush or press. Burn out smoke mixture or detonate smoke canister.

b) **Inert Loaded Projectiles, Warheads and Similar Items of All Types** loaded with inert filler to simulate service item. Remove fuse and/or spotting charge, where applicable, and burn or detonate. Remove rotating band from artillery projectiles and open the enclosure of the projectile body to expose inert filler. On items without rotating bands, open the body closure to expose the inert filler and damage the closure surface to prevent reloading or resealing.

c) **Bombs and Similar Items of All Types,** including but not limited to high explosive, practice, inert loaded, incendiary and photo flash fillers, military explosive excavating devices, demolition blocks, and grenades. Demilitarization will be accomplished by removal of explosive filler in an approved manner (e.g., wash-out, burn-out, etc.) And by deforming fuse cavity threads or removing base plate by other than normal disassembly (such as sawing) or by detonation. Grenades will be demilitarized by cutting or crushing (a minimum of 75% compression) the grenade body after item has been defused and explosive removed or by detonation.

d) **Small Explosive Items**, including but not limited to fuses, boosters, primers, detonators, firing devices, ignition cartridges, blasting caps, grenade cartridges, tracer assemblies, and similar components. Demilitarization can be accomplished by processing through a deactivation furnace at settings of 1150 degrees at burner end and 450 to 500 degrees at stack end or by mutilation. Incendiary projectiles will normally be decored to expose and assist in the compete burning of the incendiary composition. Where decoring of projectile is not necessary, processing through the deactivation furnace is adequate. Burn out 20mm HE projectiles by processing through the deactivation furnace or detonate. Processing complete small arms ammunition cartridges, all caliber's, through the deactivation furnace at controlled temperatures will result in adequate demilitarization. Fuses and boosters can be disposed of by disassembly and cutting, drilling, or punching to deform metal parts. Explosive components generated through disassembly are to be burned or detonated. Fuses may also be processed through a deactivation furnace as a complete item when disassembly is not feasible. For grenades demilitarization may be

accomplished by removal of explosive components by crushing, cutting, breaking, melting, burning, or otherwise to fully preclude their rehabilitation or further use as grenade components. Demilitarization may also be accomplished by detonation or burning as appropriate for the particular item involved.

e) **Rocket Motors, Warheads, Components and Similar Items of All Types,** including high explosive, inert, loaded, practice and smoke. Wash out or burn out rocket warhead filler and mutilate casing by crushing or cutting by torch and deforming threaded area. Disassemble and remove or burn out rocket motor propellant and cut or crush case, and deform threaded area of cases. Rocket motors and warheads may also be detonated.

f) **Mines, Anti-Personnel/Anti-Tank Explosive, Components and Similar Items of All Types** including high explosive, practice, inert loaded associated explosive components. Wash out or burn out filler and mutilate by crushing, cutting by torch, deforming threaded area or detonate. Process mine fuses, activators, and firing devices through a deactivation furnace, burn in a cage or detonate. Mine firing such as the M56 or M61 types should be crushed, cut, or burned.

g) **Ammunition and Components Which Have Been Fired or Expended, Range Residue and Other Non-Explosive Items.** All items will be rendered free of energetic materials prior to accomplishment of demilitarization. Range residue will be processed in accordance with the defense Material Disposition Manual, DOD 4160.21-M, Chapter 4, paragraph B.3, after all required demilitarization is accomplished.

1. **Artillery/Mortar Ammunition Components and Similar Items of All Types** including but not limited to high explosive, practice, inert loaded, incendiary, and smoke fillers. Remove explosive filler from projectile (wash out, burn out, etc.). Remove rotating band and deform fuse cavity threads or score or deform bourrelet or gas check band. Score practice round with a torch, displacing a minimum of one cubic inch of metal or shear into two pieces. Deform fin assembly threads and fin blades. Defective cartridge cases will be deformed by off-center punch-out of primer or split case neck or puncture the lower sidewall with a minimum of ¾ inch hole or deform lower sidewall, which will prevent chambering, or crush or press. Burn out smoke mixture or detonate smoke canister.

2. **Inert Loaded Ammunition, Projectiles, and Similar Items of All Types** loaded with inert filler to simulate service item. Remove rotating band from artillery projectiles and open the enclosure of the projectile body to expose the inert filler. On items without rotating bands, open the body closure to expose the inert filler and damage the closure surface to prevent relocating or resealing. **NOTE:** For inert loaded items (concrete, sand, plaster) a potential explosive safety hazard exists when the internal filler is not exposed or unconfined during burning, melting, or cutting. Heat generated from a demilitarization process can cause the filler, moisture and air to expand and burst sealed casings. For this reason, DRMOs will not accept inert loaded items unless the internal filler is exposed and unconfined. The internal filler may be exposed by removal of the fuse well from the cavity, removal of base plates, or by puncturing/drilling holes I the bomb casing.

3. **Bombs and Similar Items of All Types**, including but not limited to high explosive, practice, inert loaded, incendiary and photoflash fillers, military explosive excavating devices, demolition blocks and grenades. Demilitarization will be accomplished by deforming fuse cavity threads or removing base plate by other than normal disassembly (such as sawing) or by detonation. Grenades will be demilitarized by cutting or crushing (a minimum of 75% compression) the grenade body after item has been defused and explosive removed or by detonation.

4. **Rocket Motors, warheads, Components and Similar Items of All Types**, including high explosive, inert loaded, practice and smoke. Demilitarize casing by crushing or cutting by torch or deforming threaded area. Cut, crush case, or deform threaded area of rocket motor cases.

5. **Mines, Anti-Personnel/Anti-Tank, and Similar Items of All Types** including high explosive, practice, inert loaded and associated components. Demilitarize casing by crushing, or cutting by torch, and deforming threaded area or detonate. Mine firing devices such as the M56 or M61 types should be crushed, cut, or burned.

h) Instructions For Specific Ordnance Items:

1. BDU-50 Practice Bomb:

(a) Each bomb must be inspected by qualified EOD/MEC personnel to ensure that bombs are BDU-50s and that the bomb is expended. If the EOD/MEC personnel cannot verify both fuse wells, or absence thereof, it must be op-opened remotely by detonation.

(b) A 1/4 inch hole will be punched in each of the two spanner wrench receptacles, fracturing the metal to a depth in excess of 1/10 inch into the concrete filler material.

(c) A 1/4 inch punch will be utilized to further damage the threads of the nose plate, ensuring that the plate cannot be removed and replaced.

(d) Fins will be deformed or broken and paint will then be used to place a mark of contrasting color on the bomb or near the nose.

i) **Technical data** will be demilitarized by burning, shredding, or pulping.

### 5.2.3 Venting of Ordnance-Related Scrap

Prior and current practices have taken this to mean that if the MEC item is intact and resembles a piece of military ordnance, such as a 105mm HEAT (Practice) projectile, it should have a hole punched through the side to expose the filler as non-explosive. This is typically accomplished through the use of a shape charge attack. The explosively created hole exposes the filler and disfigures the projectile so that it could not be used again. For a 105 mm HEAT (Practice) round this approach is sufficient because the projectile never contained any explosives or energetic material used as a spotting charge. For a MK- 82 LDGP Bomb (Practice) this approach may not be sufficient because the bomb can contain various types of explosively activated spotting charges that have the capability to cause injury or death if exposed to the right elements such as flame from a cutting torch. And their is always the possibility that a shape charge attack may punch a hole in an explosive ordnance item

exposing the filler but not causing a detonation. Because some explosive fillers look like inert fillers the possibility for misidentification and improper certification is real.

MEC known or suspected to be inert (filled with an inert substance to simulate the weight of an explosive filler) will be explosively vented with conical-shaped charges. For the purpose of determining the fragmentation hazard area for explosive venting, it will be assumed that the MEC has an explosive filler and that a high-order detonation will occur. Venting will be considered successful when the inert filler is exposed. The vented inert ordnance item can be treated and disposed as scrap after the venting and demilitarization process is complete.

# 6.0 Certification/Disposal of Scrap Metal

The generating activity will ensure that the quantities of demilitarized property turned in to the recycling facility are accurate and that these quantities are readily verifiable by the facility. Recycling facilities will not accept any property unless the DD Form 1348-1A contains the demilitarization code or clear text statement of the demilitarization required. An example of the DD Form 1348-1A is included as Form 2-5. The generating activity is responsible for issuing a letter specifying who is authorized to sign the statement of inert certification. This letter will be kept in the project files and with the generating activity. It must be update as needed.

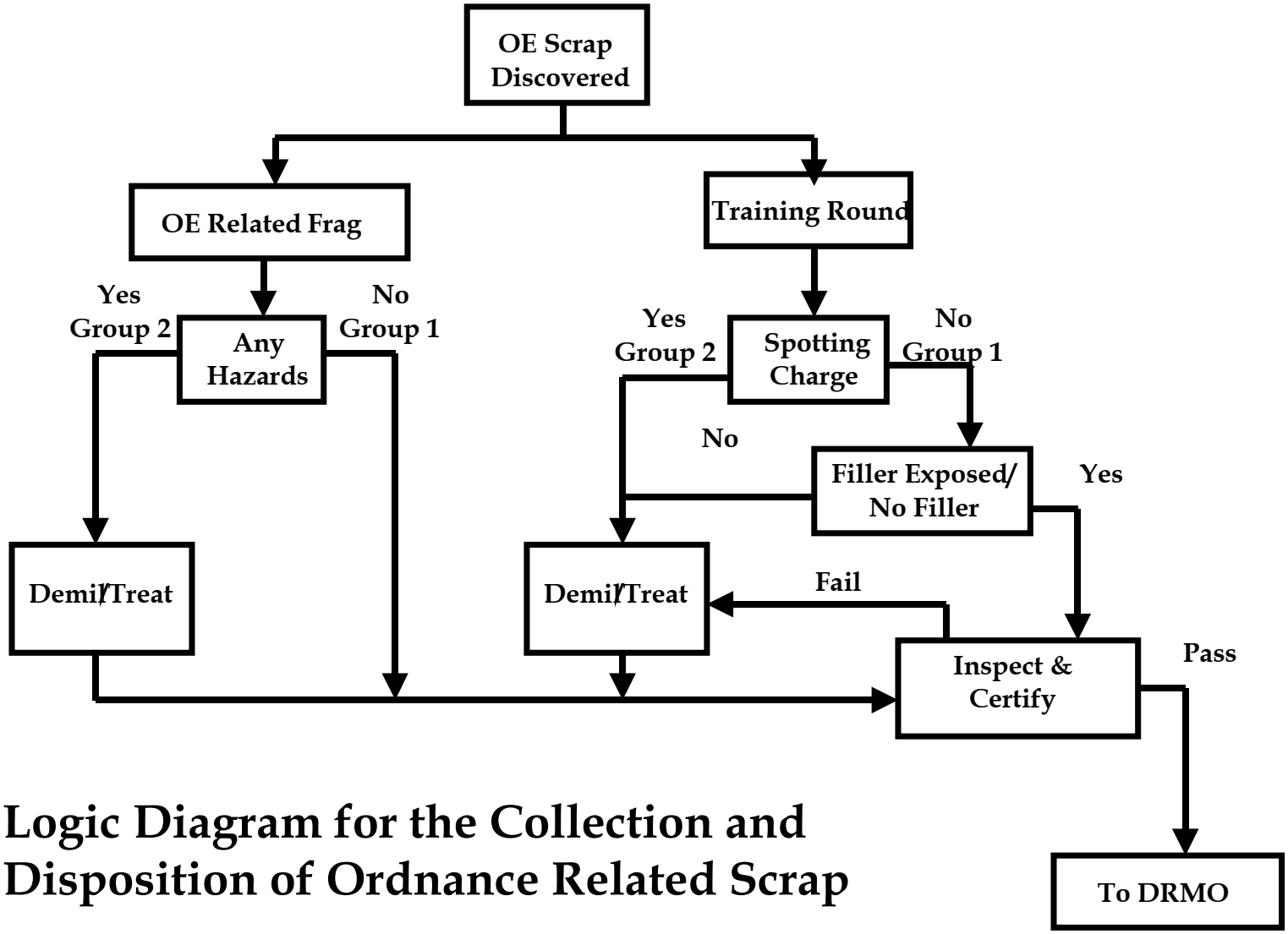
All material generated from the firing and/or demilitarization of AEDA will be rendered **free from explosives** before being referred to a recycling facility for sale. All scrap metal, generated at the site, will be disposed of at an approved scrap metal dealer, and will be transferred using DD Form 1348-1A. Prior to release of the material, the Senior MEC Supervisor will physically inspect the material in the containers to ensure that they are free of dangerous items or conduct demilitarization operations. The Senior MEC Supervisor will sign the certificate, typed on the DD Form 1348-1A, which states:

> "This certifies and verifies that the AEDA residue, Range Residue, and/or explosive contaminated property listed, has been 100 percent properly inspected, and to the best of our knowledge and belief, are inert and/or free of explosives or related materials."

The certification will be verified (countersigned) by a technically qualified U.S. government representative (U.S. citizen) designated by the responsible commander/generating activity.

Scrap will be segregated into like metals (mainly steel, aluminum, and mixed metal) and placed into palletized wooden shipping boxes. Each item placed into an inert-certified box will be inspected. The boxes will be filled, the covers will be nailed on, and a lead seal will be affixed. A Statement of Inert Certification will then be attached to the box. The box can then be picked up by a local scrap yard for disposal or recycling.

Using these procedures ensures that the collected scrap metal is properly inspected and classified. Our method includes three distinct inspections which are performed by persons of increasing levels of responsibility. The first inspection is performed at the operating grid by a qualified MEC Technician, the second is performed by the supervisor responsible for the operating grid, and the final inspection is performed by the Senior MEC Supervisor who is vested with overall responsibility.

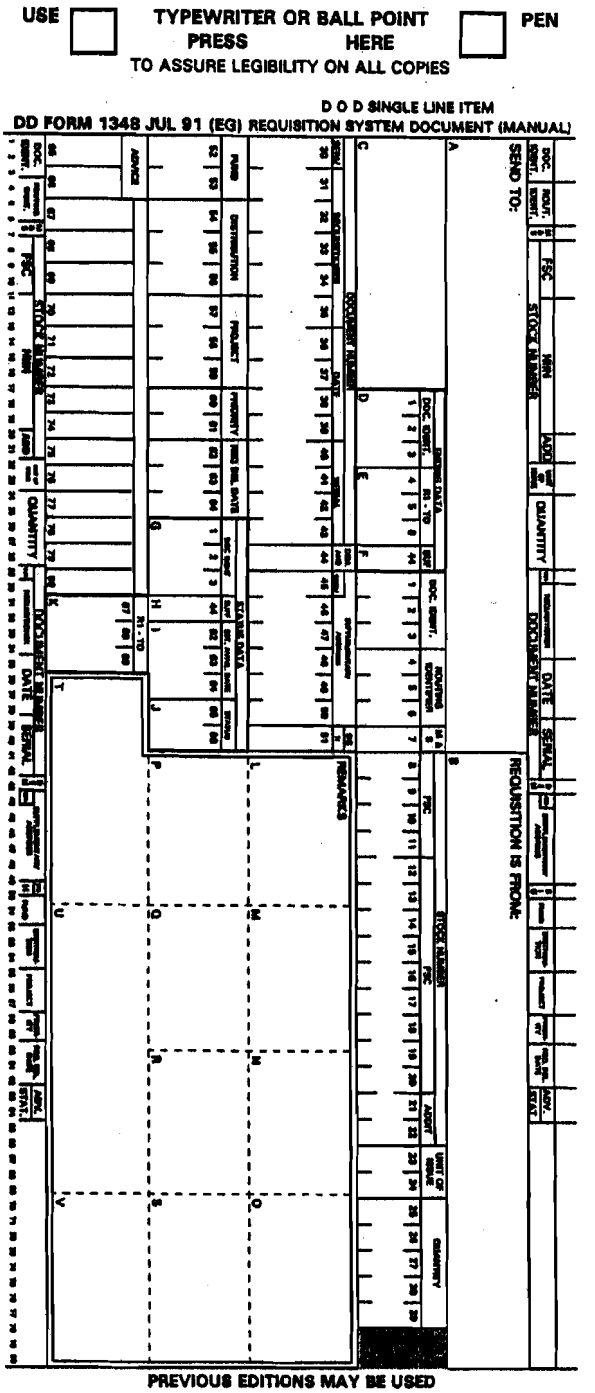



# Logic Diagram for the Collection and Disposition of Ordnance Related Scrap

**Figure 1**

# FORM 2-5

# SCRAP CERTIFICATION FORM



APPENDIX H

# Final Meeting Minutes – Vieques Technical Subcommittee Meeting, March 29-30, 2005

# Summary of Vieques Site Visits

| | | |
|---|---|---|
| TO: | Andy Crossland/EPA | Diane Wehner/NOAA |
| | Danny Rodriguez/EPA | Felix Lopez/FWS |
| | Mindy Pensak/EPA | Yarissa Martinez/EQB |
| | Michael Sivak/EPA | Andrew Smyth/TRC |
| | Chris Penny/NAVFAC | Katarina Rutkowski/TRC |
| | Jeff Harlow/NAVFAC | |
| COPIES: | Mike Barandiaran/FWS | Dennis Ballam/CH2M HILL |
| | Stacin Martin/CH2M HILL | Dave Holst/NOAA |
| | Mark Kelly/CH2M HILL | George /NOAA |
| | Kenji Butler/CH2M HILL | |
| FROM: | G. Brett Doerr/CH2M HILL | |
| DATE: | June 21, 2005 | |

**May 4, 2005**

Attendees
Danny Rodriguez/EPA
Diane Wehner/NOAA
David Holst/NOAA
George Graettinger/NOAA
Katarina Rutkowski/TRC
Mike Barandiaran/FWS
Stacin Martin/CH2M HILL
Mark Kelly/CH2M HILL
Kenji Butler/CH2M HILL
Brett Doerr/CH2M HILL

**Sediment Sampling Locations in Quebrada Downgradient of Site 7**

The attendees visited the sediment sampling locations (NDW07SD04 and NDW07SD05 on Figure 3-4 of the Draft RI Report for SWMU 7 [CH2M HILL, March 2004]) in the Quebrada that is adjacent to SWMU 7, near where it discharges to the sea. Prior to the site visit, Diane Wehner/NOAA raised a concern about language in the Draft RI Report for SWMU 7 that suggested the sediment data from these locations were not applicable to SWMU 7 because of the distance between the SWMU and the sample locations. During the site visit, it was determined that the sampling locations are representative of potential depositional areas for the Quebrada, which could receive runoff from the SWMU 7 debris area. It was further noted that the concentrations of inorganic constituents in the sediment samples are comparable to background. Therefore, it was concurred that the text of the RI Report will be revised to state that the samples are representative of potential downgradient depositional

areas, but that the inorganics concentrations are comparable to background and, therefore, do not represent unacceptable risk to ecological receptors.

**Background Surface Water/Sediment Sampling Locations Near SWMU 6**

The attendees visited SWMU 6 and the background surface water and sediment sampling locations nearby. Prior to the site visit, Mindy Pensak/EPA raised a concern about the proximity of the background surface water/sediment samples to SWMU 6, with respect to the potential influence of the SWMU on the background locations. During the site visit, it was concurred that there is adequate separation of SWMU 6 and the background surface water/sediment sample locations, and that the samples are acceptable as background.

**May 5, 2005**

Attendees
Danny Rodriguez/EPA
Andy Crossland/EPA
Wilmarie Rivera/EQB
Diane Wehner/NOAA
David Holst/NOAA
George Graettinger/NOAA
Katarina Rutkowski/TRC
Jeff Harlow/NAVFAC (partial day)
Dennis Ballam/CH2M HILL
Mark Kelly/CH2M HILL
Kenji Butler/CH2M HILL
Susana Struve/CH2M HILL (partial day)
Brett Doerr/CH2M HILL

**SWMU 4**

The attendees visited SWMU 4 to look at the sampling locations proposed in the Draft RI Workplan (CH2M HILL, June 2004). The site visit focused on the proposed sampling locations relative to the locations of the OB/OD pits and with respect to the surface topography (to evaluate surface runoff pathways). In general, the sample locations were found to adequately represent areas where runoff from the OB/OD pit areas would be expected, but several additional samples in potential depositional areas may be recommended in the forthcoming Workplan comments, such as where the quebrada terminates at the beach. This area is a depositional area and receives overland flow from the roadways that act as conduits for on-site surface water runoff.

**AOC R**

The attendees visited AOC R to look at the quebrada adjacent to the site in order to identify potential surface water/sediment sampling locations that will provide adequate representation of upstream and downstream depositional areas, as well as sampling locations adjacent to potential contaminant sources (e.g., military related debris). The attendees walked up the quebrada from a potential downstream depositional area, past the area where the debris encroaches on the quebrada, and through potential upstream depositional areas to Route 200. It was noted that the quebrada is mostly dry, with isolated

pools of water, likely the result of rain events. The attendees identified potential downgradient and upgradient depositional areas for proposed surface water/sediment sampling. The quebrada areas adjacent to the debris were dry during the visit.

It was also observed during the site visit that chlorinated water from the potable water lift/chlorination station just east of the quebrada was discharging to the quebrada. This information may be important in selecting locations for sampling, proposed analytical protocol, and interpretation of analytical results.

Several of the attendees visited the former AST location and the wells proposed in that area. It was concurred that proposed background monitoring well MW-1 will be relocated to the south (i.e., further upgradient from the former AST location), adjacent to the approximate mid-point of the west wall of Building 401, due to the sloping topography at its current proposed location.

**Gravel Pile Near AOC I**

The attendees visited the gravel pile near AOC I to evaluate its composition and determine if sampling is warranted. The regulatory agencies will discuss their observations and provide feedback to the Navy.

**May 6, 2005**

Attendees
Danny Rodriguez/EPA
Andy Crossland/EPA
Yarissa Martinez/EQB
Wilmarie Rivera/EQB
Felix Lopez/FWS
Diane Wehner/NOAA
Katarina Rutkowski/TRC
Jeff Harlow/NAVFAC
Mark Kelly/CH2M HILL
Kenji Butler/CH2M HILL
Susana Struve/CH2M HILL
Brett Doerr/CH2M HILL

**East Vieques Background Soil Sampling Locations**

The attendees visited all background soil sampling locations, except two (KTd-9 and KTd-10). With the exception of the following modifications, all background soil sampling locations were concurred upon as acceptable:

- Eliminate sampling location TI-7 due to potential perception concerns, based on its proximity to PI-13. Substitute contingency sampling location TI-C as TI-7.
- Move sampling location Kv-8 a couple hundred feet up the road (north), away from an area of disturbance noted in an aerial photo (although no area of disturbance was observed during the site visit).

- Eliminate sampling location Kv-4 due to presence of barbed wire and area of obvious disturbance (soil has been dug out and mounded). Substitute contingency sampling location Kv-C as Kv-4.
- Move sampling location Kv-6 approximately 20 feet, out of potential drainage swale, onto area of higher ground (new location marked during site visit).
- Move sampling location Qa-3 100 feet north into area less likely to be inundated with saltwater.
- Eliminate sampling location Qa-8 due to proximity to former beach landing area for military maneuvers. Substitute contingency sampling location Qa-C as Qa-8.
- Move sampling location Qa-9 to mid-point between sampling locations Qa-4 and Qa-6 due to current proposed location being where Marines may have staged a tent camp and conducted exercises.
- Move sampling location Qa-10 to mid-point between sampling locations Qa-5 and Qa-7 due to current proposed location being where Marines may have staged a tent camp and conducted exercises.
- Move sampling location KTd-8 several hundred feet north due to its current location adjacent to a buried pipeline identified in the field as a likely water line. The exposed portion of the water line was likely due to washout caused by a break in the line.

APPENDIX I

# Final Memorandum – Summary of Site Visits, June 21, 2005

# Final Meeting Minutes - Vieques Technical Subcommittee Meeting, March 29 - 30, 2005

ATTENDEES:

Yarissa Martinez/PREQB (via video phone)
Wilmarie Rivera/PREQB (via video phone)
Katarina Rutkowski/TRC
Michael Sivak/EPA
Andy Crossland/EPA
Danny Rodriguez/EPA (via video phone)
Mindy Pensak/EPA
Felix Lopez/EPA (via video phone)
Sergio Lopez/EPA (by phone)
Tim Gordon/EPA (Wendesday only)
Dianne Wehner/NOAA
Jeff Harlow/NAVFAC
John Tomik/CH2M HILL
Brett Doerr/CH2M HILL

FROM: G. Brett Doerr/CH2M HILL-VBO

DATE: June 21, 2005

This document summarizes the discussions and resulting concurrences made for various topics regarding East and West Vieques during the Vieques Technical Subcommittee Meeting held on March 29 and 30, 2005.

**Tuesday March 29, 2005**

The Subcommittee reviewed the March 7-8, 2005 Meeting Summary in track changes mode, discussed and approved revisions, and concurred on the summary as final.

Total Petroleum Hydrocarbons (TPH)

Michael Sivak/EPA summarized the information he obtained from EPA Headquarters regarding risk assessments involving TPH. Headquarters informed him that CERCLA does have jurisdiction over TPH, depending on its source. In addition, OSWER issued a document (SRC SF 01-031/10-16-2002, PPRTV Derivation Support Document for Total Petroleum Hydrocarbons) that compares the Massachusetts Department of Environmental Protection (MADEP) methodology for evaluating potential human health risk to petroleum hydrocarbon constituents to the methodology developed by the TPH Criteria Working Group (TPHCWG). The PPRTV document includes recommendations regarding which methodology is more appropriate for the various constituent fractions. Micheal Sivak/EPA was not aware of any Region II sites where this methodology has been applied. He also indicated that at all new NPL listed sites where TPH was suspected to have been released

(such as AOCs E and I), the processes identified in the PPRTV document would likely be required.

Jeff Harlow/Navy noted the Navy's concern that potential risk will be "double counted" if risk calculations are done for VOCs/SVOCs and TPH separately. Michael Sivak/EPA noted that the VOCs/SVOCs that are components of TPH will be subtracted from the TPH before the risk calculations are done in order to avoid the "double counting."

It was recognized that EPA, EQB, and DOI need to discuss PPRTV document in order to develop concurrence on a recommended approach. It was also recognized that the Navy needs to discuss this issue internally, with respect to what is being done at other Navy facilities and what is being done across EPA Region 2. Following these individual discussions, the Navy, EPA, EQB, and DOI will convene a discussion of the topic.

Mindy Pensak/EPA noted that one of the end results of these discussions should be a decision tree on if/when/how TPH will be analyzed and evaluated for sites. EPA took an action to develop the decision tree. She also indicated that BTAG will not be using this method for ecological assessments because there are no ecological screening criteria for TPH.

Diane Wehner/NOAA noted that it is not necessary to analyze surface water and sediment for TPH for ecological consideration, again because there are no ecological criteria for TPH.

It was concurred that the AOC I and AOC E work plans will not be revised until the TPH topic is resolved.

Asphalt/Rubble Pile Near AOC I

Prior to the Technical Subcommittee Meeting, EPA and EQB held a conference call to discuss the asphalt/rubble pile near AOC I. They concurred that a determination of the need for sampling around the pile would be deferred until the May 2005 site visit by the agencies. The Subcommittee concurred that the need for sampling and the number of samples (estimated to be four sample locations) would be confirmed during the May 2005 site visit. If sampling is necessary, the Subcommittee concurred that the site should be considered as a new site rather than a part of AOC I. The rationale cited by EPA/EQB for sampling is:

1. The Navy is assumed to have placed the asphalt/rubble there.
2. There is no known documentation of what is in the pile.

Jeff Harlow/Navy noted that the Navy will need to discuss this further, given that the pile appears to be composed of the same material as the roadways throughout the facility. The Subcommittee concurred that the pile will be visited during the May 2005 CTC meeting.

Surface Soil Sampling

The EPA passed out a decision process for determining when surface soil samples should be collected from the top 12 inches versus the top 24 inches.

The Subcommittee agreed that for the East Vieques Background Investigation, 0-6" surface soil samples are appropriate because of the statistical comparability of the surface and

subsurface soil data on West Vieques, and that the East Vieques background soil data can be used in comparison with the surface soil samples (0-12" and 0-24") collected at the various sites.

Subsurface Soil Sampling

The Subcommittee agreed that subsurface soil sampling depths at all sites will be determined based on field screening results. A default depth of 4 to 6 feet below grade will be selected if field screening or site-specific data do not indicate that a different depth is more appropriate.

AOC R

The Subcommittee discussed the proposed samples for AOC R. EQB noted that there is an ephemeral stream containing MEC at AOC R, but that the stream is not part of the conceptual model, nor are samples proposed in the stream. Felix Lopez/FWS noted that there is a bulldozed debris pile that encroaches on the stream.

It was concurred that the presence of the debris pile will be added to the workplan conceptual model and that samples in the pile and ephemeral stream will be added. It was further concurred that the workplan will be revised to state that the surface water/sediment sample locations will be selected by the Subcommittee during a site visit and that the proposed samples figure will be revised to show the proposed surface water/sediment samples, based on targeting depositional areas in the stream. In addition, upgradient and downgradient surface water and sediment samples will be colllected.

EPA also recommended adding language to the revised plan that includes several contingency samples, based on observations made after vegetation clearance, and that the locations of these samples will be selected with the concurrence of EPA and EQB. EPA also requested full TAL/TCL analysis unless a class of chemicals was not detected in samples collected during the PA/SI.

NOAA also noted that the spatial relationship of AOC R with other sites should be presented in the revised plan, and that data comparison in the background section should include ecological criteria in addition to human health criteria. Figure 4-2 will be revised to show the locations of the AOC J samples (downgradient of AOC R).

It was noted that in Figure 4-2, the symbol for MEC sample locations needs to be revised to indicate explosives analysis.

The existing surface soil samples were discussed. It was noted that the existing surface soil samples were collected from the top 6 inches. Katarina Rutkowski/TRC suggested collecting deeper surface soil samples at those locations or determining if there were PID readings collected in the top 6 inches that did not detect the presence of VOCs above background. Katarina Rutkowski/TRC also noted her concern about the potential for soil contamination beneath the concrete pad because of the cracks noted.

Jeff Harlow/Navy noted that UXO clearance will be done not only at the proposed sample locations, but also around the general area of AOC R. In addition, the AOC boundary shown in the figures will be researched to deterime if it is the access restriction boundary identified in the deed. It was further noted that access restriction boundary may be adjusted

based on the investigation findings, but that the boundary is irrelevant with respect to the extent of investigation, which will identify the extent of contamination regardless of the boundary location.

The historical information will be re-evaluated to determine if there is any information concerning the potential for an AST to be located on the northern side of the building.

SWMU 4

CH2M HILL presented a summary of SWMU 4 background, objectives, and proposed samples. It was noted that there were over 23,000 anomalies identified and about 11,000 removed.

EPA stated that its concerns regarding conducting an environmental investigation before all munitions are removed are:

1. Potential for a continuing source of contamination (i.e., MEC) after the nature and extent have been characterized.

2. Potential for changing the environmental conditions during the MEC removal (e.g., during digging up of MEC, contaminants at depth may be brought to surface).

Felix Lopez/FWS and EPA stated its assumption was that the environmental investigation would be done after the MEC clearance had been completed to a depth of 12 inches. Michael Sivak/EPA noted that if BIPs take place after the environmental investigation occurs, the distribution of contamination may change and invalidate the use of existing data to calculate exposure point concentrations. However, NOAA stated its desire not want to wait until munitions are removed to assess environmental impacts to the lagoon.

Following discussion, it was understood by the Subcommittee that environmental investigation is warranted at this time to identify nature and extent and potential risks. However, because MEC will be left in place indefinitely (unless prioritized higher), additional sampling will be necessary when the MEC is removed in the future.

It was concurred that surface soil samples outside of pits will be collected from 0 to 6" below grade. This depth was selected for this site based on an evaluation of significant release mechanisms for potential contamination. Impacts in surface soil are most likely to occur in shallow surface soils associated with the aerial deposition of contaminants as a result of OB/OD activities.

It was concurred that a notation will be made in the revised plan that in the pits, the soil will be characterized from ground surface to the water table and that subsurface soil samples will be collected at the bottom of the pit, corresponding to the maximum depth at which MEC is observed. The figures will also be revised to note that the trench is one of the pits that will be sampled.

EPA requested that additional samples be collected away from the high-density anomaly areas to confirm the extent and ensure adequate sample distribution for evaluating potential human health risks.

**Wednesday March 30, 2005**

Background Data Use

The Subcommittee discussed the use of background data in the investigation and decision making process. CH2M HILL passed out a decision process flowchart for the use of background data, which shows where in the investigation and risk decision making processes the background data are utilized. EPA noted that an internal discussion would take place once various personnel reviewed the proposed decision process flowchart. The primary discussion point is whether risk assessment is necessary when inorganics are the only constituents above screening criteria, but all concentrations are consistent with background.

Soil Geochemical Data

The Subcommittee discussed the collection and use of soil geochemical data. It was generally understood that geochemical data will not necessarily be needed for the purpose of determining whether data sets are to be combined, but that they can help to explain differences in constituent concentrations, if present. The Subcommittee agreed that geochemical analysis (e.g., TOC, pH, redox potential and cation exchange capacity) will be added to the sampling protocol for the East Background investigation.

Phase I RFI for Eight PI/PAOC Sites

The Subcommittee discussed the Draft Phase I RFI Work Plan for the Eight PI/PAOC Sites. It was clarified by Tim Gordon/EPA that a Phase I RFI is synonymous with a release assessment, in which the primary intent is to determine if there has been a release, not to perform a comprehensive nature and extent evaluation.

FWS indicated its review of the Work Plan and comment submittal would be completed within 2 weeks. TRC noted it needed to obtain a copy of the Work Plan and indicated a review would be complete within 2 weeks.

It was also concurred that recognizing the relatively poor quality of aerial photos (with respect to scale and detail), it was concurred that schematic drawings of proposed sampling locations will be prepared where they assist in comprehending the proposed sampling rationale. These schematic drawings will show historic buildings, etc., where the information is available.

Regarding PAOC S, NOAA stated that if the former pipeline traversed sediment of the lagoon, then sediment samples should be added. It was recognized that this may be ascertained during the May 2005 site visit.

It was concurred that instead of necessarily collecting the subsurface soil samples along the pipeline from 4 to 6 feet, PID screening and visual observations will be made and the subsurface sample interval selected based on the results.

Regarding surface soil sampling for the eight PI/PAOC sites, it was concurred that along the pipeline (PAOC S), 0 to 24 inches will be the surface soil sample depth, and that 0 to 12 inches will be the surface soil sample depth at the other seven PI/PAOC sites. The Navy

noted that additional samples are planned along the pipeline (i.e., smaller inter-sample spacing) and at pipeline valve locations, if found.

The process for determining whether there was a release and the need for a full RFI was discussed. Specifically, if exceedances of generic PRGs are identified, is a full RFI automatically necessary? EPA noted that professional judgment should be used regarding the need to do just limited additional sampling versus a full RFI. Recognizing that an adequate dataset is necessary to perform a risk assessment, release assessment will be made by comparison to generic PRGs. However, if PRG exceedances are limited (in terms of location and magnitude), professional judgment will be used to determine if several additional samples may be adequate to make risk management decisions for a particular site (including the need for a full RFI). The professional judgment should be made as a consensus of the Navy and other agencies, based on joint review of the data.

Regarding PI7, there is some uncertainty in what the historical information indicates regarding the potential for waste to have been buried in the former quarry. Felix Lopez/FWS noted that there were partially buried drums stained with tar and/or labeled as fuel observed at the site.

EPA stated that analysis of PCBs needs to be added to the power plant PAOC S investigation.

Phase I RFI Report

Tim Gordon/EPA requested that, because of the time until the background investigation is completed and the data compared to the Phase I RFI data (and RFI Report revised), a data summary report be prepared for the original Phase I RFI sites in order to provide information to the public. Further, he stated that the report will not likely go out for a public comment period because it will be just a data summary (i.e., will not have conclusions or recommendations), but it will be placed in the repository for review. It was further requested that the background data use flowchart be added to this data summary report.

Electronic Database

The Subcommittee discussed the database format in which EPA would like electronic data submitted. EPA requested that data collected on Vieques be submitted in an EDD format required by Region 2. The Navy will evaluate the differences between the standard Navy EDD format and what is being requested by EPA and provide feedback to the Subcommittee.

May 2005 Site Visits

The Subcommittee listed the sites proposed for visiting during May 2005 CTC meeting. The purpose of the visits will be to concur on the sample locations. EPA indicated that it is not necessary that they visit all the sample locations to concur on their locations. The following agenda was tentatively set, pending CH2M HILL's evaluation of site accessibility.

May 5 – East Vieques Background Soil locations, PI4, PI7, PAOC S

May 6 – Asphalt/rubble pile, SWMU 4, AOC R, AOC J, SWMU 7, historic background surface water and sediment locations near SWMU 6

Upcoming Technical Subcommittee Conference Calls

The Subcommittee set tentative dates and topics for upcoming conference calls.

April 19, 2005 (9 am-12 noon EDST) – May site visits, TPH, Background data use process flowchart

April 27, 2005 (9 am-12 noon EDST) – Tentatively discuss response to comments on various submittals (and/or other topic(s), as appropriate)

**APPENDIX J**

# Final Meeting Minutes – Vieques Technical Subcommittee Meeting, June 21-22, 2005

# Final Meeting Minutes - Vieques Technical Subcommittee Meeting, June 21 - 22, 2005

ATTENDEES:

Yarissa Martinez/PREQB (via video phone)
Katarina Rutkowski/TRC
Michael Sivak/EPA (Tuesday only)
Andy Crossland/EPA
Danny Rodriguez/EPA (via video phone)
Mindy Pensak/EPA (via phone)
Felix Lopez/EPA (via phone)
Sergio Lopez/EPA
Dianne Wehner/Ridolfi (Tuesday only)
Jeff Harlow/NAVFAC
Chris Penny/NAVFAC (Tuesday only)
John Tomik/CH2M HILL (via phone, Tuesday only)
Brett Doerr/CH2M HILL

FROM: G. Brett Doerr/CH2M HILL-VBO

DATE: August 23, 2005

This document summarizes the discussions and resulting concurrences made for various topics during the Vieques Technical Subcommittee Meeting held on Tuesday June 21 and Wednesday June 22, 2005 at EPA Region 2 headquarters in New York. Topics discussed during the meeting comprised:

1. Adoption of CERCLA processes/terminology for east Vieques
2. Comments/response to comments and technical approach for eight PI/PAOC sites proposed for Phase I RFI (i.e., November 2004 Draft Phase I RFI Work Plan)
3. Comments/response to comments for and technical approach for various other PI/PAOC sites.
4. Path forward for gravel/asphalt pile near AOC I
5. Path forward for TPH analysis and evaluation
6. Navy CLEAN database format versus EPA Region 2 database format

**Tuesday June 21, 2005**

The Subcommittee reviewed the March 7-8, 2005 Meeting Summary in track changes mode, discussed and approved revisions, and concurred on the summary as final.

The Subcommittee reviewed the May 4-6, 2005 Site Visit Summary in track changes mode, discussed and approved revisions, and concurred on the summary as final.

Adoption of CERCLA Processes/Terminology for East Vieques

The Subcommittee concurred that all future environmental investigations (and applicable documentation) for east Vieques will follow the CERCLA process. Therefore, when the Draft Phase I RFI Work Plan for the eight PI/PAOC sites and the Draft Phase I RFI Report for the original 12 sites are revised and resubmitted, their titles will be changed to reflect the equivalent CERCLA terminology (e.g., PA/SI). Further, revised figures will be organized to display sites that are adjacent to each other, rather than necessarily producing one figure per site. This will allow better comprehension of potential site interactions and, therefore, a potentially coordinated sampling approach.

Technical Approach for the Eight PI/PAOC Sites Included in the Draft Phase I RFI Work Plan

The Subcommittee discussed each of the eight PI/PAOC sites and reached concurrence on the scope and technical approach. It is noted here that although not all Navy responses included in the Draft Phase I RFI Work Plan response-to-comments memorandum (submitted under cover letter dated May 27, 2005) were acceptable to the regulatory agencies, concurrence on the scope and technical approach was reached during the June 21-22, 2005 Technical Subcommittee Meeting, which is documented in these meeting minutes, and supersede previous comments and response to comments, as applicable. Once the meeting minutes are approved by the meeting attendee agencies, they will be used to revise the Phase I RFI Work Plan as final, obviating the need for an additional round of comments and response to comments.

The summaries below reflect modifications made to the proposed scope of work in the Draft Phase I RFI Work Plan (November 30, 2004). Therefore, the proposed scope in the Draft Work Plan is accepted, with the additions, deletions, and changes summarized below.

General Comments

Where contamination is encountered at depths below 6 feet below ground surface (bgs), then two subsurface soil samples will be taken – one at 4 to 6 feet bgs for risk assessment purposes and one at a lower depth where contaminations present for the purpose of determining the nature and extent of subsurface impacts.

PI-4

Referring to Figure 2-1 of the Draft Phase I RFI Work Plan, two soil borings will be added to the "white" area in the southwest portion of the figure. At each location, a surface soil and subsurface soil sample will be collected in accordance with the surface soil and subsurface soil sampling protocol previously concurred upon by the Subcommittee. In addition, a well will be installed in the southernmost of these two borings. The analytical protocol will be the same as that for the other soil and groundwater samples.

Referring to Figure 2-1, the well located near the southeast corner of the site will be moved toward the west, to a more central downgradient location.

A copy of Figure 2-1 was made and marked up by EPA to show the two additional soil borings discussed above, the relocated well discussed above, and the additional well within the trenched areas proposed in the Navy response to comments.

In addition to the above, it was concurred that the EBS sample locations PI4-1 and PI4-2 will be resampled. At each location, both surface and subsurface soil samples will be collected for VOCs, SVOCs, and metals.

PI-7

The Subcommittee concurred that prior to selecting sampling locations, a reconnaissance of the former quarry portion of the site will be conducted. The reconnaissance will include a visual site inspection to identify debris, including drums that were previously observed. Any debris observed will be located using GPS. Results of the reconnaissance will be used to prepare a schematic map of the general site topography, showing the locations of prominent features, including debris. During the site inspection, a shovel or auger will be used at locations where debris is observed and along each transect to help evaluate the extent of debris, including drums, in the subsurface and to determine general soil depths. A metal detector will also be used during the site inspection to help identify any buried metallic items. The site inspection will be conducted throughout all open areas of the former quarry. Where there is dense vegetation, transects will be cut using the TAZ, with coordination with FWS. The Work Plan will be revised to reflect this reconnaissance, but the Subcommittee concurred that it can take place prior to revising the Work Plan in order to expedite preparation of the final Work Plan.

Once the reconnaissance is completed, a schematic map of the general site topography, including the locations of any identified debris, will be prepared and submitted to the agencies for review, together with a revised proposed sampling approach (in the form of a Work Plan Addendum), based on the results of the reconnaissance. The Subcommittee will review the reconnaissance results and proposed sampling approach and come to concurrence, including whether well(s) are needed and, if so, its(their) location(s).

In addition to the above, an attempt will be made to identify the person(s) who reported the drum disposal in order to get additional information on how the disposal took place (e.g., surficial, burial, etc.). Felix Lopez faxed a markup of Figure 2-4 of the Draft Phase I RFI Work Plan showing the approximate locations of drums that he observed and photographed.

Regarding the northern portion of PI-7 (i.e., former radar communication facility), EPA would also like a reconnaissance performed, comprising a visual inspection to identify any debris or disturbed areas. If debris or disturbed areas are identified, samples will be proposed in those areas; if not, three composite samples will be collected from 0 to 2 feet, representing individual samples collected at locations evenly distributed across the presumed site area.

PAOC J, K, and L

The Subcommittee reviewed the proposed sampling approach for these three sites together, due to their close proximity. It was concurred that one figure will be produced that shows all three sites and proposed samples. Sample locations at adjacent sites will

be adjusted to provide reasonable spacing between them. In addition, two wells will be installed – one at the PAOC J southeasternmost boring location, and one at the PAOC L southernmost location (referring to Figures 2-6 and 2-8, respectively, of the Draft Phase I RFI Work Plan). These two wells will provide groundwater data at the downgradient edges of PAOC J/K (PAOC K is immediately adjacent to the northern portion of PAOC J) and PAOC L.

A copy of Figure 2-7 was made and marked up by EPA to show the two new well locations discussed above.

PAOC N (and power house portion of PAOC S)

The Subcommittee reviewed the proposed sampling locations at PAOC N and the power house portion of PAOC S together. Based on their proximity and the groundwater sampling objectives, the three proposed wells will be relocated. Referring to Figure 2-9 of the Draft Phase I RFI Work Plan, the southernmost well at PAOC N will be moved to coincide with the soil boring on the south side of the filling station. The northern well in Figure 2-9 will be moved to the west side of the rectangular building to the north. Finally, the central soil boring at PAOC S will be completed as the third well.

A copy of Figure 2-9 was made and marked up by EPA to show the three new well locations discussed above.

PAOC S (pipeline portion)

The Subcommittee concurred that two surface soil samples (0 to 2 feet) will be added in the depositional area downgradient of the pipeline, but upgradient of the saltflat, in the area where the land crabs were collected. The locations will be identified in the field by FWS and NOAA during the Phase I RFI fieldwork.

Soil samples will be collected every 500 feet along the pipeline.

PAOC U

The Subcommittee concurred that samples for pH will be collected at all soil sampling locations. In addition, one soil boring in the approximate center of the site will be completed as a well.

A copy of Figure 2-14 of the Draft Phase I RFI Work Plan was made and marked up by EPA to show the well location. It coincides with the soil boring in the approximate center of the site.

Other Topics from June 21, 2005 Meeting

TPH

The Subcommittee discussed analysis/evaluation of TPH at CERCLA sites in Vieques. Jeff Harlow/NAVFAC stated that analysis/evaluation of TPH at CERCLA sites is an agency-wide position; therefore, a unique approach cannot be applied to Vieques without Navy approval. To that end, Jeff Harlow/NAVFAC will find out at what level the decision regarding TPH analysis/evaluation at Vieques will be made. He will also take OSWER Directive 9285.7-53 (Human Health Toxicity Values in Superfund Risk

Assessments) to Navy management for review. This directive does not specifically discuss TPH with respect to human health risk assessments in Superfund, but does state that PPRTVs are the second tier of toxicity values (IRIS being Tier 1). Michael Sivak/EPA passed out the PPRTV for TPH used by EPA during a previous Subcommittee Meeting.

Michael Sivak/EPA will find out if TPH is being remediated at Superfund sites (especially Federal Facilities), and, if so, if the PPRTV for TPH is being used.

Until the issue is further resolved, Jeff Harlow/NAVFAC stated that the Navy will address TPH at sites where USTs were located in accordance with the Puerto Rico UST regulations (e.g., TPH, BTEX), and will address TPH at sites where USTs were not located by evaluating CERCLA constituents (e.g., VOCs, PAHs).

Data Presentation

The Subcommittee concurred that on future detection tables, the qualifiers and reporting limits will be included. In addition, the text will note detects, but will focus detailed discussion on exceedances.

**Wednesday June 22, 2005**

Environmental Database Format

The Navy discussed the Navy environmental database format versus the EPA Region 2 format with Andy Crossland/EPA. Brett Doerr/CH2M HILL gave Andy Crossland/EPA a spreadsheet showing the differences between the two databases. Because the Navy environmental database is Navy-wide rather than region- or site-specific, its format is established by a Navy standard. It was concurred that CH2M HILL will re-evaluate the differences to determine which of the Region 2 fields are designated as "required." In addition, Brett Doerr/CH2M HILL will see if the Navy database can be "dumped" into the EPA Region 2 format, leaving blanks for fields that are not stored. Jeff Harlow/NAVFAC will find out if there is a Navy database spec that can be shared with EPA.

Asphalt/Gravel Pile Near AOC I

The need for sampling at the asphalt/gravel pile near AOC I was discussed, based on the regulatory site visit that was conducted in May 2005. Andy Crossland/EPA stated that the regulatory agencies had not reached a consensus on the sampling specifics, but agreed some sampling should be done. The Subcommittee discussed potential sample types and locations and the regulatory agencies proposed that two surface soil/subsurface soil samples be collected between the pile and where runoff most likely moves toward ephemeral stream. The surface soil would be collected from 0 to 1 foot and the subsurface soil sample would be collected from the interval of the highest PID reading or 4 to 6 feet in the absence of an elevated PID reading.

In addition to the soil samples, one sediment sample (0 to 6 inches) would be collected from the ephemeral stream channel where runoff from the pile most likely enters, and one sediment sample would be collected upgradient of this location. All samples would be collected following procedures in previously approved work plans.

Considerable discussion took place regarding the nature of the asphalt/gravel pile, its likely relationship to the asphalt roads in Vieques, and the likelihood of finding asphalt-related constituents (i.e., BTEX, PAHs) associated with road-building materials. One of the stated regulatory concerns is that when the gravel/asphalt material was stockpiled, solvents may have been used to clean the truck bed. Based on this concern, Jeff Harlow/NAVFAC proposed to collect the samples proposed by the regulators, but to analyze them for constituents not related to road-building materials (i.e., VOCs less BTEX, and SVOCs less PAHs). Mindy Pensak provided some feedback from EPA personnel that suggested relatively high levels of PAHs are found in the soil adjacent to asphalt roads. EPA took an action to discuss among the regulatory agencies the applicability of BTEX and PAHs to the proposed sampling associated with the asphalt/gravel pile. Additional discussion among the Subcommittee members will be necessary to make a final determination on the need for sampling and, if so, the analytical protocol.

PI/PAOC Sites Not Included in Phase I RFI Work Plan

The Subcommittee discussed the background information, the Navy's proposed path forward, and the regulatory agencies' positions regarding the proposed path forward for several PI/PAOC sites that were not proposed for further investigation in the Phase I RFI Work Plan. The discussion utilized a table prepared by CH2M HILL that listed each PI/PAOC site, a brief description, the EBS sampling results (as applicable), the EBS recommendation, the Phase I RFI Report recommendation, and regulatory comments made on the recommendation.

A number of sites (PI-13, 14, 18, 19, PAOC EE, FF) are proposed for an MEC inspection. If the MEC inspection does not identify the presence of MEC, the sites are recommended for NFA. If MEC is identified, the sites are recommended for transfer to the MRP. EPA requested that clarification of how the MEC inspections are to be conducted be provided because EPA is not comfortable with a visual inspection being the only means of verifying the presence/absence of MEC (if that is what an "MEC inspection" means). CH2M HILL will provide clarification of how the MEC inspection is to be conducted.

A number of sites (PI-1, 2, 3, 9, 15, 16, 17, PAOC Y, Z, AA, BB, CC, DD) are proposed for transfer to the MRP. EPA and EQB concur conceptually with this proposal under the assumption that after/during the MRP, the same environmental evaluation process that is being done for other PI/PAOC sites is done for the sites transferred to the MRP.

For PI-5, it was concurred that the photographs in the EBS appendix will be re-evaluated to determine what potential sources are present. A figure will be prepared that shows the relative relationship of the areas noted and distributed to the Subcommittee to determine if/where samples need to be collected.

For PI-6, EPA wants a minimum of four surface soil samples (0 to 1 foot) around the pad (one on each side) analyzed for PCBs because EPA does not consider wipe samples sufficient for making an assessment of the presence/absence of contamination. In addition, EPA requested a better figure for PI-6 that is larger scale and shows site features. Based on the revised figure, EPA may request additional samples.

For PI-11, further evaluation of this site is warranted. Piping is underground; however, only surface soil samples were collected during the EBS.

For PI-12, FWS is concerned that although the site was a residence prior to the 1940s, that it was being maintained (e.g., vegetation mowed) into the 1980s for some unknown reason. If historical knowledge of the activities cannot be found, FWS suggests a site reconnaissance be done to select sample locations to verify no releases occurred.

For PI-20, EPA/EQB recommended a site reconnaissance be performed to attempt to locate the debris area at the location of the 1964 photograph, including the use of a shovel.

Because there is discrepancy among the various regulatory agency members (and between the agency members and the Navy) regarding the need for and scope of sampling at the various PI/PAOC sites and because regulatory comments on the EBS were not taken into consideration in making the recommendations for the PI/PAOC sites, further discussion on the PI/PAOC sites was deferred until the next Subcommittee Meeting.

Upcoming Technical Subcommittee Meeting

The Subcommittee set the following tentative date (and potential agenda topic) for the next Subcommittee Meeting:

August 16 and 17, 2005 – PI/PAOC sites

**APPENDIX K**

# Final Meeting Minutes – Vieques Technical Subcommittee Conference Call, October 11, 2005

# Final Meeting Minutes - Vieques Technical Subcommittee Conference Call, October 11, 2005

ATTENDEES:

Yarissa Martinez/PREQB
Wilmarie Rivera/PREQB
Katarina Rutkowski/TRC
Diana Cutt/EPA
Danny Rodriguez/EPA
Mindy Pensak/EPA
Sergio Lopez/EPA
Oscar Diaz/FWS
Felix Lopez/FWS
Dianne Wehner/Ridolfi
Jeff Harlow/NAVFAC
Chris Penny/NAVFAC
Jennifer Ottoson/CH2M HILL
Brett Doerr/CH2M HILL

FROM: G. Brett Doerr/CH2M HILL-VBO

DATE: November 3, 2005

This document summarizes the discussions during the Vieques Technical Subcommittee conference call held on October 11, 2005. Topics discussed during the meeting comprised:

1. Outstanding topics on Former NASD AOC E and I Draft Final Supplemental RI Work Plans
2. Site reconnaissance performed at Former VNTR PI-7 and proposed technical approach for the PA/SI
3. Other outstanding topics on Former VNTR PI/PAOC Draft Final PA/SI Work Plan
4. Outstanding topics on Former NASD AOC R Draft Final RI Work Plan

AOC E and I Draft Final Supplemental RI Work Plans

It was noted that not all of the analytical methods in the work plans were the most current. The text/tables of the work plan will be modified to ensure the most current analytical methods being utilized by laboratories are shown. However, it should be noted that the groundwater analytical methods shown in the AOC E Work Plan reflect the methods that were current when the samples were collected, so they will not be revised.

The AOC E Work Plan proposed collecting additional groundwater samples for only TPH-ORO to supplement existing groundwater TPH results (i.e., GRO and DRO). The team

agreed to analyze all groundwater samples collected during the upcoming fieldwork for the full TPH suite (i.e., TPH-GRO/DRO/ORO).

Total dissolved solids (TDS) analysis will be added for groundwater samples at these sites in order to help determine whether the groundwater is considered potable.

PI-7 Site Reconnaissance and Proposed Sampling Approach

The results of the PI-7 site reconnaissance were discussed, specifically focusing on the figures showing the area of site reconnaissance and the observations made. Referring to the work plan figures showing the site reconnaissance findings and proposed sampling (Figures 2-4, 2-5, and 2-6), the following clarifications/changes were concurred upon:

- To avoid the misconception that the boundaries shown in the figures represent formal site boundaries, the legend descriptors will be changed to "areas" rather than "boundaries."
- It was concurred that in addition to the sampling to be conducted during the PA/SI, additional site reconnaissance will be performed. Prior to performing the additional reconnaissance, historical aerial photographs and LIDAR results will be evaluated, together with additional information provided by FWS, and the proposed area of reconnaissance provided to the Technical Subcommittee for review. The area will include a debris area identified by Oscar Diaz in the northern part of the site.
- During the PA/SI sampling activities, a shovel will be used in an attempt to identify the subsurface anomalies shown in Figures 2-4, 2-5, and 2-6. If any of them are identified as a potential source of contamination from historical waste disposal practices, additional surface/subsurface soil samples will be collected at their locations. A notation about contingency samples will be added to the work plan.
- In Figure 2-5, one of the soil samples adjacent to the drum location will be revised to be a surface soil, subsurface soil, and monitoring well location.
- In Figure 2-6, the two small white dots in the northwest quadrant of the figure were actually subsurface anomalies located within several feet of each other. The dots will be changed to co-located red dots in the revised figure and the soil samples shown adjacent to them will be removed.
- It was agreed that the soil samples to be collected and monitoring wells to be installed at the drum piles will be installed as close to (or within) the drum piles as possible. The text will be revised to reflect this information and Figure 2-6 will be revised to show the dots closer to drum piles.
- In Figure 2-6, an additional surface/subsurface soil sample will be added adjacent to the east side of the easternmost white dot labeled "Approx. 10 drums."
- It was agreed that if the drums can be moved in order to sample under them, that this is the preferable sampling approach.

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- The last paragraph in Section 3.2.2 will be revised as follows:

"Subsurface soil samples will be collected using the hollow stem auger drilling method with a 3-inch-diameter stainless steel split spoon. At each location, continuous split-spoon samples will be collected from ground surface to bedrock or the water table, whichever is shallower. Subsurface soil samples will be collected for analysis as follows:

- At each location, a subsurface soil sample will be collected in a 2-ft interval within the 2 to 6 ft zone, based on where visual and/or OVA screening suggests the presence of contamination. In the absence of visual or screening evidence of potential contamination, the subsurface soil sample will be collected from the 4 to 6-ft interval (or just above the water table or bedrock, if encountered before this depth).
- If bedrock is found deeper than 6 feet, and if contamination is suspected below 6 feet, based on visual and/or OVA screening, an additional subsurface soil sample will be collected from the interval where the highest level of contamination is suspected."

- In the second paragraph of Section 2, regarding elimination of herbicides from the analytical protocol, text will be added that indicates there is no historical information that suggests there was disposal of herbicides at the 8 PI/PAOC sites included in this investigation.
- In the last paragraph before Section 1.1, the text about acute and chronic hazards will be removed and the last two sentences combined to read: "It is noted that if there are relatively few exceedances of screening criteria in the PA/SI data and the magnitude of the exceedances is small, professional judgment, in coordination with discussion among the stakeholder agencies, will be used to determine if several additional samples may be adequate to make risk management decisions for a particular site (including the need for a full RI)."

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It was concurred that the same change to the subsurface sampling protocol described above will be made to the AOC R Work Plan.

It was noted that some of the guidance documents referenced have had more recent versions published. It was further noted that the documents referenced were current at the time the work plan was submitted. It was concurred that text will be added to the work plan that states the most current versions of the guidance documents will be used during report preparation.

In Figure 3-1, the plants and animals will be removed as receptors for subsurface soil. In addition, the term "ditch" in the legend will be renamed "ephemeral stream" to be consistent with the text of the work plan.

In the third paragraph in Section 3.3, where it refers to the use of the Puerto Rico Water Quality Standards, text will be added that other criteria will be used (e.g., AWQC) if Puerto Rico Water Quality Standards are not available for particular constituents.

In Section 4.2.3, for NDARMW06, "100 feet north" will be removed from the bullet to indicate that the well is at the immediate downgradient edge of the target area.

Katarina Rutkowski will e-mail requested revisions for Table 5-1.

Mindy Pensak will e-mail additional ecological comments.